Electrical World

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To the Men on Committees

EACH year closes upon results of the work of scores of committees of the various electrical organizations. Hundreds of men and dozens of companies have devoted time and money to advance the industry without direct benefit to themselves. Oftentimes the work is arduous and exacting. Generally it is thankless. Occasionally the work itself is performed by one group or one individual and is credited to others because of organization routine. It is not possible to enroll publicly the names of all these men. Yet no summary of any year's work is justly made without recognition of the spirit of service which prompts the majority of those who carry on the detail of organization activities. In the hands of meetings, papers, policy and finance committees, to mention only four, lies the final success of organization work. When a great leader dies the wheels of industry stop for five minutes in his honor. It is worth while once a year to halt the thought of the industry and to point to the men doing committee work. What they have done and what their successors will do fixes in general the runways of tremendous forces for our technical, engineering and commercial progress.

Matching Local Progress with National Development

THOSE who got the most out of Electrical Prosperity Week, unless the records are at fault, are those who individually caught the spirit of the movement and put it to work in their own enterprises. An instance makes the point clear. A dealer in a city was asked what results he saw in his business. "I put two posters in my window," he said, "but I didn't notice any increase in business." In the same town a department store developed an electrical sales week around a window demonstration of electrically operated household appliances that gave its merchandise manager a new conception of the possibilities of these goods. In another instance an electrical manufacturer sold $60,000 worth of his product by matching a sales plan of his own with the movement as a whole. In each of these cases the forces at work to make the public receptive to a consideration of electrical appliances were the same. Two concerns capitalized the situation; the other one failed to do so. There are at least two lessons in the recent celebration of Prosperity Week. One follows directly from the example given. No amount of broad co-operative effort will result in individual advantage unless the individual takes the initiative. In the second place the celebration has given the industry as a whole a conception of what it can do. Successful as was the effort, it fell short of its full measure of accomplishment in so far as there were varying degrees of individual enterprise in carrying out the plan. With this proof of the good that can be done as an example, there should be a greater opportunity for a future campaign. With one success of record and establishing the necessary proof of possibilities, the next campaign, by concentrating on the more definite guidance of what the individual can do, should prove even more successful.

Getting More Men to Know Their Costs

A UNIVERSAL knowledge of costs is a most effective and logical method of price maintenance. Price-cutting without reason, the kind of price-cutting that eventually either lowers a community's standard of quality or puts the unthinking price competitor out of business, is generally the result of sheer ignorance of costs. Manufacturers who undersell the average market, contractors who bid on a set of plans and charge themselves no salaries, dealers who mark up their stock on a margin to bring the price below that of their next-door neighbor, are in business on a false basis that sooner or later is disastrous to themselves as well as to the community. These seem self-evident truths, and yet every week men waste their own money and the public's because of lack of a general understanding of the elements and totals of their costs. The Harvard Bureau of Business Research has done constructive work in analyzing the costs of doing business in the retail boot and shoe industry and the grocery trade. The results of these investigations are available for the price of the pamphlets. Work of this sort has also been undertaken by private enterprises, notably in the retail clothing field and among certain associations, including the electrical contractors. Basic investigations of this sort may be called an applied engineering method in business. Cost knowledge will not supplant brain power in running a business, but it will prevent a business from going on the rocks and will maintain standards for quality in a community or an industry which are for the mutual benefit of the industry and the community.

The Cobbler's Barefoot Children

EFFICIENT and scientific illumination is the text of modern central-station lighting preachments when present or prospective customers make up the audiences. Yet to how many companies which through their business activity are classed as modern may be applied the old adage "Put your own house in order first"? How

many companies are there that are making daily illumination tests with portable photometers for their customers but ignore their own shortcomings? "Insufficiently lighted, with lighting units injudiciously placed," describes the conditions of an astonishingly great number of engine, turbine, boiler and pump rooms, in spite of the fact that good lighting is most essential in these places. Poor illumination does not bring the best results from men working eight, ten and oftentimes twelve hours a day. This in turn is reflected in the economy and efficiency of the whole plant. Of the large sums of money spent annually in different ways in an effort to raise the operating efficiency of the station, a greater return cannot be shown for any single method than for improved station lighting. For instance, the use of a tungsten lamp and shade properly placed at gages and water columns, where the rays are most useful, points at once to an improvement whose value it is hard to estimate but whose benefit is apparent. Further, a little attention in maintaining the efficiency of lighting units by cleaning off dust and grease goes a long way in this direction. These suggestions have been made many times before; yet the uncorrected conditions still exist and still justify calling attention to them. The efficiency of men and the economy of plant are not the only points involved. The remedy will be reflected in advertising the company's policy to practice what it preaches, which is certain to be propagated by the employees directly benefited.

Commission Membership

ONE more example of the difficulties in obtaining public service commissions whose members shall be guided solely by the public welfare in making their decisions has just passed in review in the First District of New York. An "investigation" has culminated in the removal of Chairman McCall and the appointment of Oscar S. Straus. Regulative legislation was launched in 1907 with high hopes by Governor Hughes. The bipartisan first commission consisted of three Republicans and two Democrats. When Governor Whitman took office last year he found all the members Democrats. Then the "investigation" was started which has now culminated in the removal of Chairman McCall for his alleged ownership of stock in a company under his jurisdiction. Whether or not this stock was actually transferred by Mr. McCall to his wife, the certificate was still too close to the presiding officer of the commission to meet that compliance with the spirit of the law which is expected from a leading official. Admirable as is the selection of Mr. Straus from the viewpoint of his high standards in public office, he brings to his new work no detail knowledge of the questions involved, and to that extent he cannot judge at the start of the weight of various elements in the problems. His selection, despite its general fitness, brings up the perennial question of what should be the qualifications of members of commissions. An ideal three-member commission, one student of conditions thinks, should be selected by this recipe: one engineer, one business man and one lawyer. But what is an engineer, what is a business man, and what is a lawyer? For commission purposes it would seem that the engineer is a man with a technical knowledge of the facts and a real determination to get at them, that the business man is the individual who considers facts from the standpoint of their results in practice, and that the lawyer visualizes and knows how to put public machinery into action. Such a commission, if composed of able men, would certainly assure a well-balanced consideration of great problems, and if it were well supported by an efficient staff it should render fine service in the fair settlement of public utility issues.

Mobilizing Electrical Men for Defense

IN the efforts now being made for some measure of military preparedness in case of need the electrical industries can well afford to co-operate. Mr. Edison has recently remarked that the next war will be one of machines. He might have added, of technical resources as well. There is a splendid opportunity for electrical men the country over to make plans for preparedness within their own especial fields of usefulness. Consider the matter of communication, for instance. Why should it not be possible to organize inside the big telephone and telegraph companies of the country bodies of volunteers who would familiarize themselves thoroughly with field telephony and telegraphy worked out in full co-ordination with the other military forces? With encouragement and a little special training a body of experts could be got together sufficient to meet the needs of any military operations that the United States would ever be called on to undertake for defense. Our country is so big and the extent of coast to be watched so great that the utmost facilities for communication become of peculiarly great importance.

In particular, wireless work in the field would play a great part in case of hostilities, and the force to take charge of this branch of the service on a large scale could be easily developed. Again, a searchlight service with well-trained operators is important for coast defense, and if the government will provide the necessary material a searchlight division composed chiefly of central-station men and employees from electrical manufacturing companies could be organized and brought to a high state of efficiency with a relatively small expenditure of time and money. Another body of electrically trained men is necessary for harbor-mining service since it is evident that mine laying is going to play a very important part in coast defense. It is a simple matter to draw on the technically trained men now in the electrical business for very efficient assistance, as was well shown during the Spanish war. The importance of these and other tasks requiring special skill is obvious to the military authorities and hearty co-operation is to be expected from them in any volunteer movements of this sort. To effect the voluntary mobilization of the talent which is actually at hand in the electrical industries is the first problem to be solved, and

efforts in this direction should be promptly made to back up the preparations made along more familiar military lines. One need not be a militarist to appreciate the value of being ready in case of trouble.

Rules for Employees

CENTRAL stations are now taking steps to develop codes of service which shall give to each employee a knowledge of company policies. In living up to instructions of this character the central-station man builds the reputation of his company and of himself in the community. The opportunity for applying these principles specially is almost unlimited, and in these days of striving after high business ideals, of putting personality into the interesting and important work of fitting a highly technical service to the needs of growing communities, the formulation of such codes is both helpful and stimulating. If a company seeking to put such a code into practice lets the public know that such principles are what it stands for, by posting them in its offices and by permitting them to circulate outside the sales department, and above all by trying to square its acts with these aims, its management need worry very little about adverse public opinion, municipal ownership, or any other unwelcome handicap to its largest usefulness and enduring success in the community.

Preventing Building Vibration

VIBRATIONS transmitted to buildings from moving machinery are probably more disagreeable than dangerous in most cases. Outside of congested business districts ordinary vibrations receive little attention, but in the designing of machinery and foundations for substations under metropolitan conditions the elimination of even slight vibrations is an insurance against possible future difficulties with abutting property owners. On another page is presented an analysis of vibrations in a turbo-generator, showing the nature of these vibrations as recorded on the floors of adjacent buildings. It should be pointed out that the experiments show that vibration is caused by traffic in the street as well as by the machinery, so that the elimination of vibration generally means a survey of conditions outside as well as inside the structure.

Consideration of these particular experiments recalls others made in textile mills and in investigations of the balancing of high-speed rotating members. Some years ago a large machinery company conducted some classic experiments into the relations between static balance and rotating balance. It was found that a rotating member which was balanced perfectly on knife edges when at rest would not necessarily remain balanced when rotating at high speeds. Similarly investigations into textile-mill vibrations indicate that it is possible to dampen vibration produced by reciprocating parts by finding the "wave-lengths" of such vibrations and by changing these wave-lengths by weighting members of the building structure so as to throw them "out of step." The problem is one of refinement in design and construction to meet special conditions. The fact that corrective measures have been taken by the engineers of both manufacturers and central stations is simply another example of the great variety of conditions which are taken into consideration in the engineering design room.

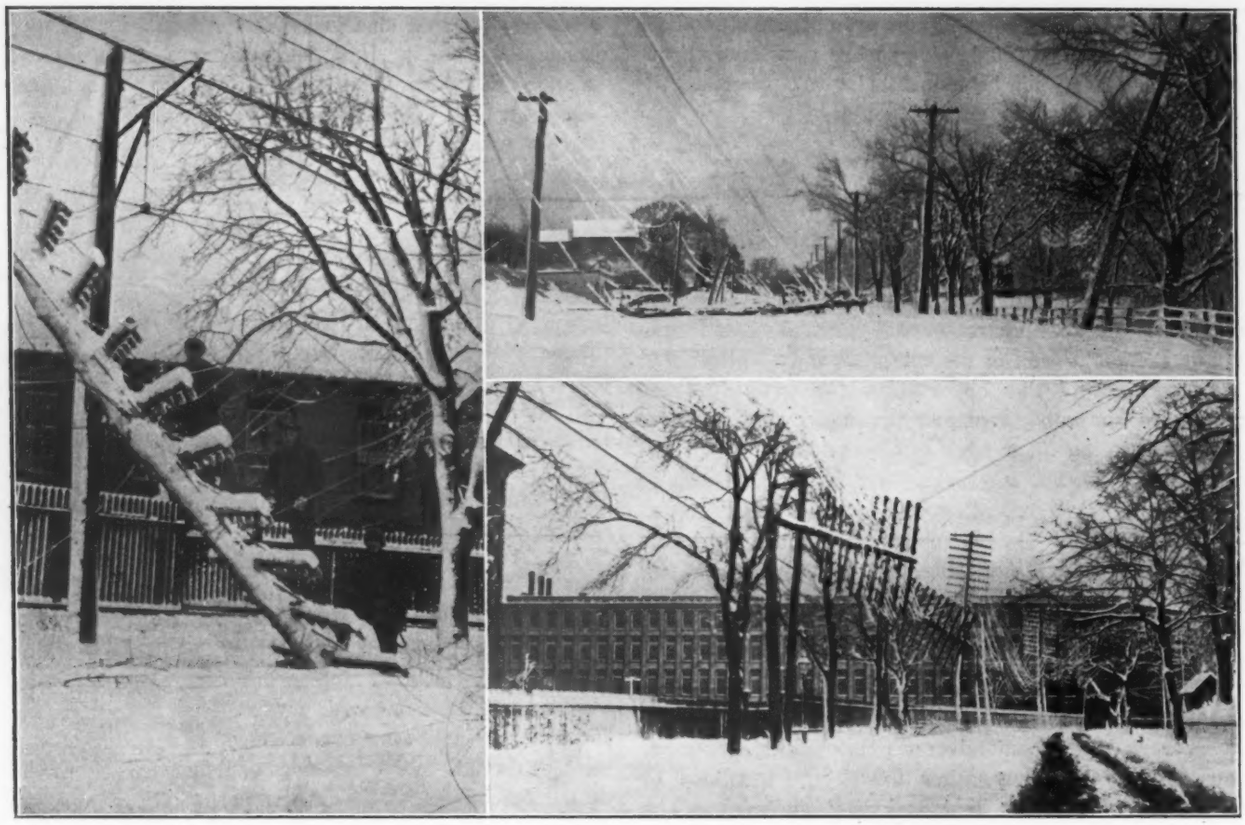
Possibilities for Industrial Heating Increase

THE announcement about a year ago that a Middle Western central station had contracted to supply an automobile factory with power aggregating 6000 kw. for heating japanning ovens caused a perceptible stir. Now comes another announcement that the baking of sand cores for foundry work can perhaps be done better electrically than in any other manner. Conservative members of the Industrial Electric Heating Association will not say positively that the electric way of baking sand cores is the best way, but research experiments which have been and are being conducted by some of the members seem to indicate that many owners of core-baking ovens will soon be customers of central stations.

It is unlikely that on the basis of fuel cost alone electricity will be able to supplant gas or oil in core-baking ovens. Experience has, however, shown that two-thirds of gas-baked cores are imperfect. It often happens that a large part of each ovenful is overdone while an equally large part is underdone. The remainder may be considered satisfactorily baked cores. The good cores are good because they were properly baked. Electric heat, lending itself so easily to perfect control, will, therefore, it is thought, produce ovenfuls of cores which are 100 per cent good, and thus on the whole reduce the cost of core-making. Final and conclusive data on the subject are not yet available, but the possibilities of the load merit the prompt co-operation of engineering departments of central stations and manufacturers.

Editorial Announcement

IN this, the third issue of the month, appear articles bearing on engineering and scientific advance. Last week the number was largely given over to subjects of operating practice. Next week, the fourth issue of the month, will be the regular commercial number, with a leading article on the easy-payment plan of selling domestic electrical appliances, incorporating the experience of a prominent manufacturer who has employed this method with success. The following issue, that of Jan. 1, which appears at a time when the industry is planning the work of the year ahead, will present an important group of review articles, including interviews with the presidents of the leading electrical bodies looking ahead for the future, and reviews of the various engineering branches of the industry, of relations with the public, and of commerce and trade.



Snow, Ice and Wind Carry Down Poles and Many Overhead Wires in Vicinity of New York City

Beginning Monday evening of this week, a severe snow and sleet storm broke upon the North Atlantic seaboard States, coating overhead lines of all kinds with icy envelopes and carrying the lighter conductors to the ground. In many cases the sleet and congealed snow about the wires reached diameters of 2 in. to 5 in., and hundreds of telephone and telegraph wires went down as wires broke and poles snapped under the heavy burden and high wind. Overhead trolley systems were rendered inoperative for a time, but little actual damage was done to electric-light systems and transmission lines. The severity of the storm appeared to center about New York City. Fast trains from all directions were hours late from battling with the snowdrifts. The underground telephone and telegraph lines from New York to the principal Eastern cities proved their value in maintaining communication while all other lines were out of service. The total damage wrought by this week's storm to the overhead lines of the railroad, telephone and telegraph companies has been estimated at $500,000. The accompanying pictures were taken by George B. Cornell, superintendent of the Yonkers (N. Y.) Electric Light & Power Company, and illustrate storm conditions in Westchester County and the Hudson Valley, although the lines of the Yonkers lighting company suffered little injury.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

STEEL BARRED IN ELECTRICAL FITTINGS

Conference of Manufacturers and Underwriters Prohibits Its Use for Current-Carrying Parts in Electrical Fittings and Supplies

At a conference held in the Hotel Biltmore, New York, Wednesday morning between the Underwriters' Laboratories and about fifty manufacturers of electrical supplies, fittings, etc., it was decided to restrict rigidly the use of plain or coated steel for electrical purposes. So many requests had been received by the Underwriters' Laboratories for permission to use steel or brass-coated iron as a substitute for copper or brass in certain electrical fittings that the Underwriters determined on the conference in order to obtain the sense of electrical manufacturers on the subject. After a thorough airing of all the reasons for the use of iron and steel, it was unanimously decided "that for wiring supplies steel or iron, plain or plated, shall not be used for current-carrying parts or for movable binding screws or for binding screws and nuts where cable lugs are not used."

It was also unanimously decided that for panelboards, switchboards and knife switches "steel or iron, plain or plated, shall not be used for current-carrying parts or for movable wire binding screws or for wire binding screws and nuts where cable lugs are not used. Hinge bolts, spring washers and nuts of knife switches are considered as not being current-carrying parts."

C. Eidlitz reported that at a meeting on Tuesday of the switchboard and panelboard section of the Associated Manufacturers of Electrical Supplies that section went on record as being opposed to the use of any sheet iron or steel, in any form, for current-carrying parts. H. Sargent reported that the socket section of the Associated Manufacturers of Electrical Supplies also was opposed to the use of steel in wiring supplies. Frank Watts of the snap-switch section of the Associated Manufacturers of Electrical Supplies reported that that section also voted to oppose the use of steel in electrical snap switches where it was relied on for carrying current.

The discussion brought out the fact that there are many cases where steel is essential for mechanical

strength, notably in clamping busbar strips together and in fastening copper parts to bases. Here the function of the steel is not that of an electrical conductor. It was shown that in certain types of switches where one brass screw is relied on to carry the current and another screw used for fastening the part to the base the other screw might preferably be of steel for purely mechanical reasons. However, it was considered dangerous to countenance the presence of steel in any shape or condition in electrical wiring supplies, owing to the universal use of these in parts of the country where the steel might be subject to rapid corrosion, as, for instance, along the seacoast.

LOS ANGELES CONDEMNATION HEARING

Southern California Edison Company's Case Must Be Finally Passed on by Courts, Says Railroad Commission

As a result of the preliminary hearing in the case of the city of Los Angeles versus the Southern California Edison Company, a report of which was published in the ELECTRICAL WORLD for Dec. 4, the California Railroad Commission ruled as follows:

"It is not the function of this commission to determine whether the city can by condemnation take a part of a franchise held or exercised by the company and leave the remainder of the franchise in effect, but under the law it is the duty of the commission to fix just compensation for a part of a public-utility property for which valuation is asked by a city, and the commission may thus be called upon to fix the compensation for part of the franchise, any controversy as to the legal rights of the city to make such separation to be settled by the courts."

Thus after the railroad commission has rendered its decision there will still be the question whether a city under its powers of eminent domain can condemn a part of the physical properties of a public utility company and at the same time take over the part of the franchises of that company necessary for the operation of the physical property condemned, or whether the city must take all of the franchises, paying a just valuation on the entire public privileges owned by the company.

With this understanding and after the city had filed an amendment to its original application indicating specifically just what franchise rights were desired, the hearing was resumed on Dec. 13 and is expected to continue through several weeks.

Upon the re-opening of the case H. H. Trowbridge, general counsel for the Southern California Edison Company, outlined in general terms the items for which just compensation totaling $22,850,000 would be claimed. These included:

Severance damage	$11,000,000
Value of the business	4,500,000
Value of physical property	4,500,000
Cost of selling bonds and securities	350,000
Cost of rebuilding transmission lines around Los Angeles	1,500,000
Substation No. 3	1,000,000

Forty-five per cent of the company's gross and net revenues, Mr. Trowbridge said, would be shown to come from business within Los Angeles.

The greater part of the first three days of the hearing was devoted to the testimony of R. H. Ballard, secretary and assistant general manager, and B. F. Pearson, superintendent, who reviewed the company's history, gave the reasons for each step in its development, and explained in detail the effect on the company's business if part or all the Los Angeles load were lost.

In a voluminous report made public at the hearing Richard Sachse, chief engineer for the railroad commission, announced finding the value of the physical plant which the city wishes to buy to be $3,830,000. He estimated that the city could duplicate this new for $4,800,000.

Jovian Order Plans to Increase Membership and Efficiency of Organization

Plans are now being laid by the present administration of the Jovian Order to increase the membership and efficiency of the organization in the local communities, according to a statement made to the ELECTRICAL WORLD by Ell C. Bennett, Mercury of the national body. At present there are seventy local leagues, and there is a possibility of increasing this number to 135 or 150.

There will be an intensified campaign to increase the membership, both by enlarging the present leagues and by establishing a league in every community that is of sufficient size to warrant the undertaking. Efforts will be made to bring to life the few leagues that have, through lack of interest, gone out of existence.

The administration believes that the greatest value of the order lies in its commercial benefits to the local communities. To this end it is planned to charter the local leagues under a standardized set of by-laws and to point out the way for the activities of the leagues to take on a constructive nature. These by-laws, while they will be of a rigid nature, will, however, admit of whatever flexibility is necessary to comply with local conditions.

Up to the present time, beginning with October, more members have been admitted to the Jovian Order than in any other period of the same length in the history of the organization.

Electrified Railroad Equipment Proves Successful Under Test

The first actual tests of the Chicago, Milwaukee & St. Paul Railroad Company's new electrified mountain divisions have just been made by officials and directors of the system, who toured the completed sections of the 440-mile electrified district in three special cars drawn by one of the new 260-ton, 3000-volt electric locomotives. The officials who accompanied the test "special" included A. J. Earling, president of the St. Paul; H. B. Earling, vice-president; H. R. Williams, vice-president; C. A. Goodnow, assistant to the president; Percy Rockefeller, John D. Ryan of the Montana Power Company, A. J. Pettit of Milwaukee, Charles W. Harkness and Dolad Geddes of New York, all members of the directorate, and A. H. Armstrong of the General Electric Company, with other officials of that corporation. After making passenger-train tests, running at all speeds up to 70 miles an hour, the officials witnessed tonnage tests, in which locomotives used on passenger trains, equipped for heavy hauling instead of speed, pulled 2500 tons at a uniform speed of 16 miles an hour. At the conclusion of the tests President Earling and the other officials expressed gratification over their complete success. It is expected that the all-steel transcontinental trains of this company will be operated electrically over the continental divide shortly after the first of the year. While the cost of the work has been $20,000,000, the saving in fuel, in increased hauling capacity, in maintenance of speed schedules and in mechanical upkeep will be so large that a return of 20 per cent a year on the investment is anticipated. The regenerative braking device in the equipment of the electric locomotives proved under the tests to be completely successful.

DENVER'S GODDESS "ELECTRA" CROWNED AT THE OPENING OF THE ELECTRICAL SHOW SEEN ON THE LEFT

A PORTION OF THE 125 EXHIBITS DISPLAYED AT THE CINCINNATI ELECTRICAL SHOW DURING PROSPERITY WEEK

RESULTS ATTAINED IN PROSPERITY WEEK

Additional Returns from the Six-Day Business and Advertising Campaign Confirm Earlier Reports of Success

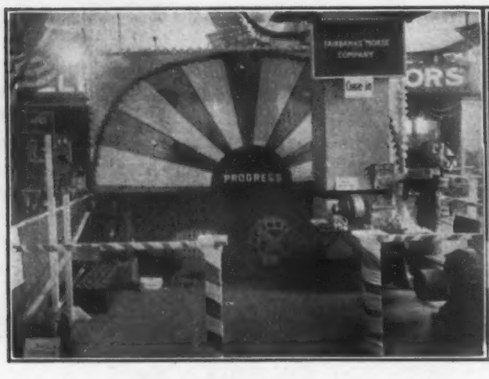
With the lapse of two weeks since the close of Electrical Prosperity Week, which was from Nov. 29 to Dec. 4, the electrical interests have had sufficient time to survey the results of the campaign from all angles. The great majority of those interviewed by representatives of the ELECTRICAL WORLD feel that the campaign was most successful, not only in its immediate results of new business but in educating the public.

There were reported last week in these columns some of the returns received by the ELECTRICAL WORLD. While space will not permit a review of all the celebrations, which were held in every corner of the country, the following paragraphs will indicate the almost universal success attained.

Sales Movement Aroused in New England

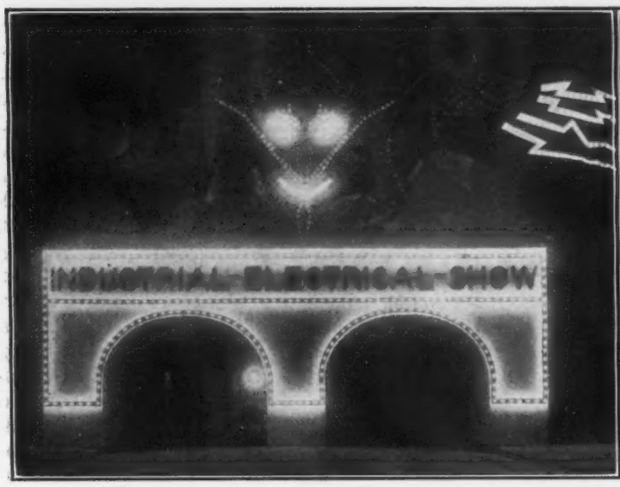
Electrical Prosperity Week swept through New England on a rising tide of popular interest which crowded many central-station offices with inquiring purchasers of appliances, increased the number of visitors to the establishments of fixture dealers, household-device retailers and wiring contractors, and aroused a sales movement certain in the opinion of most managers to last through the holiday season. At Boston the Edison Electric Illuminating Company had one of the busiest weeks ever known, and evidence of sustained buying is already coming in to the appliance department. At Providence, R. I., an electric show fostered by the Narragansett Electric Lighting Company and local dealers and contractors was attended by 15,000 people, although the exhibition was open only in the evening and was about 3 miles from the center of the city. During the week the sales of the electric shop run by this company totaled $1,000, and the staff has been too busy as yet with continuing business to figure detailed results. At Portland, Me., the Cumberland County Power & Light Company carried a remarkably attractive and complete exhibition of appliances and lighting devices in the waiting room of the street-railway department at Monument Square. Leading electrical contractors of Springfield, Mass., report decided increases in sales and house-wiring developments. Intensive sales of appliances were featured successfully at the Worcester Electric Light Company's headquarters. The Stone & Webster Company at Lowell, Mass., felt the stimulus of the week in its business, owing in part to vigorous preliminary campaigning, and the Pittsfield (Mass.) Electric Company and local electrical concerns took active parts in the week's proceedings. These and many other electrical interests hold that the national character of the week's work produced results difficult in many cases to trace directly but certain to popularize electricity to a greater degree than ever.

October and November sales of electric heating appliances, says A. M. Stuart, president of the Stuart-Howland Company of Boston, were over three times the sales of the similar period of last year, with December sales holding equally well. With the cumulative effect of extensive and wise publicity and with popularization of appliances through successful use, he anticipates 1916 as the best heating-appliance year in the history of the industry.



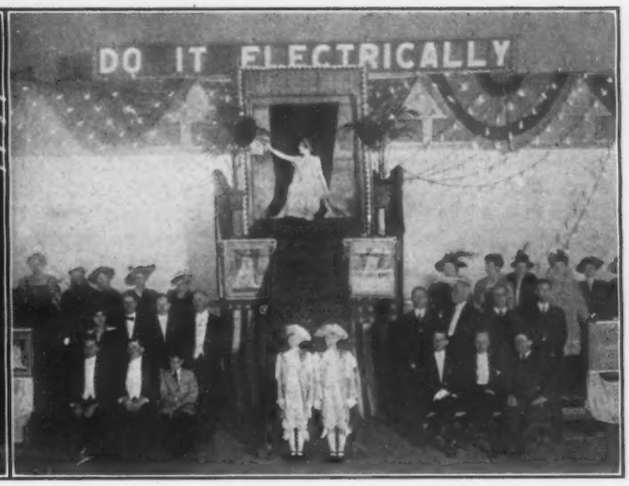
ONE OF THE EXHIBITS AT THE ATLANTA SHOW

THE ELECTRICAL PARADE WAS THE BIGGEST EVENT OF THE WEEK AT ASHEVILLE, N. C.



JOVIAN EMBLEM AT ENTRANCE TO DENVER SHOW

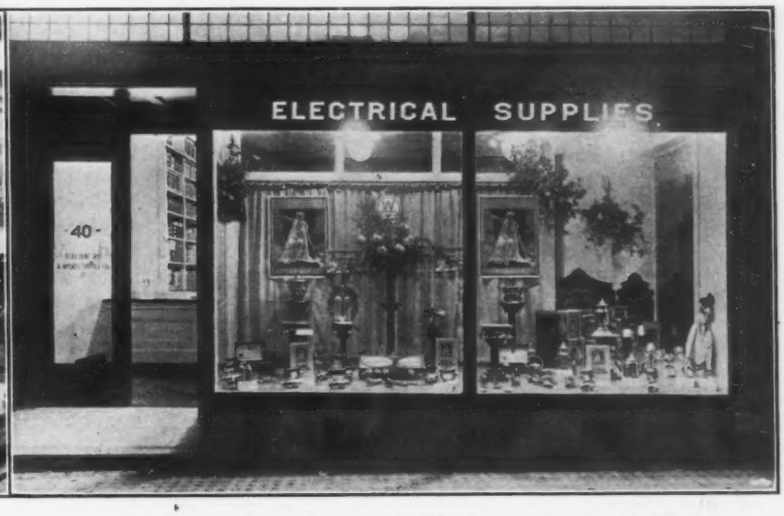
Electrical devices for the farm, home and factory were exhibited to interested crowds of spectators.



"ELECTRA" HELD COURT AT SAN FRANCISCO BALL

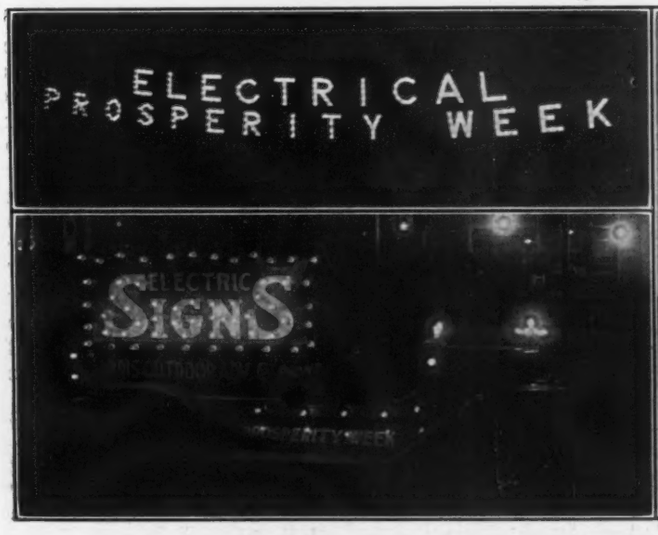
The electrical interests joined with the Exposition officials to make the prosperity ball a success.

A LOS ANGELES MERCHANT'S DISPLAY



A TYPICAL PROSPERITY-WEEK WINDOW IN SAN FRANCISCO

On the Pacific Coast department stores, hardware stores and other merchants, as well as the electrical sales interests, made good use of their windows to attract electrical trade and stimulate Christmas purchases of electrical appliances.



PROMINENT ADVERTISEMENTS IN GALVESTON

Much was done during the week in the Southeast to educate the public to the use of electricity.

A DISPLAY AT THE SEATTLE SHOW

The crowds at the show were so great that it was difficult to handle them.

Week a Success in Louisville

Judged purely from the standpoint of commercial results, the celebration of Electrical Prosperity Week in Louisville, Ky., was a success. Dealers took orders for a large amount of electrical goods at the show, contractors booked many contracts for house-wiring and other jobs, and electric-vehicle dealers sold cars for immediate delivery to buyers who were interested at the exhibition. The Louisville Gas & Electric Company found 700 prospective customers who were interested in having their houses wired.

An electrical show and a parade marked Electrical Prosperity Week in Galveston, Tex. The total expenses for the week were less than $100. A 10 per cent discount on appliances was given during the week and, according to Robert A. Wood, manager of the new-business department of the Brush Electric Company, "the sales were enormous."

Denver's Sales Increase 25 Per Cent

Prosperity Week in Denver was preceded by a masked ball on Saturday evening, Nov. 27, which was one of the biggest affairs of its kind ever held in Denver. The electric show proper opened on Tuesday, Nov. 30, when "Electra" was crowned "Queen of Electricity and Prosperity" for the week. Electrical devices for the home, the farm and the factory were shown. Exhibits of Colorado home industries were housed in attractive booths. Co-operation was given to the electrical men by the Denver Manufacturers' Association, the department-store merchants, business men of all lines, professional men, women's organizations, civic bodies, and even the teachers and pupils of public schools. To preface the week, the Denver Gas & Electric Light Company opened a unique publicity campaign. Instead of telling of the progress of the company itself, the publicity campaign was directed toward telling in the newspapers the story of the industrial and economical progress of every industry of any importance in the State. By Dec. 7 the Christmas sales of the lighting company were 25 per cent ahead of the holiday season of last year.

Asheville Citizens See Electricity Made

The electrical parade which proved to be the biggest event of the week at Asheville, N. C., was led by "Electra" seated on a dais constructed on a powerful motor car which was decorated in white and outlined with miniature electric lamps. A novelty which attracted much attention was the first train of three floats entered by the Asheville Power & Light Company, consisting of a complete working electric plant of 4-kw. rating, mounted on a 1-ton electric truck which trailed the two additional floats representing "the dining-room electrical" and "the kitchen electrical." Energy for lamps and cooking devices was supplied by the plant in full operation during the parade. "The support and friendly spirit shown by the public and the local press lead us to believe," says J. C. Donald, general superintendent of the Asheville Power & Light Company, "that our time and money were well spent and that Electrical Prosperity Week has done much to unify, in the minds of the public, the electrical interests and the interests of the city at large."

Los Angeles Merchants Pleased with Results

Merchants in different lines in Los Angeles, according to interviews had with an ELECTRICAL WORLD representative, believe that Electrical Prosperity Week had both an immediate and a future value. R. R. Thomas, president of the Electric Equipment Company, stated that the week "put money in his pocket." The campaign, in his opinion, was particularly beneficial to dealers in household appliances.

"Our own internal awakening was the best thing Electrical Prosperity Week did for us," said the sales manager of the Parmelee-Dohrmen Company, dealer in china, glassware and household goods. This firm featured electrical goods for the holiday season. A. A. Schneider, merchandise manager of the J. W. Robinson Company, dealing in dry goods and selling a line of electric lamps, believes that the campaign was beneficial from the standpoint of influencing future sales. J. H. Pieper of the Southern California Edison Company considers that the amount of publicity obtained and the amount of sales-promotion work done are of far-reaching importance. Business, he feels, will result from it in the future. E. C. Ebert, vice-president of the Bacion Light Company, said: "Our Electrical Prosperity Week advertising and window features created more talk and interest than any other display we have made." P. H. Booth, second vice-president and sales manager of the Hotpoint Electric Heating Company, said: "We never expected the amount of publicity we got. It has aroused to advertising and selling activity dealers who had not experimented in these lines before. I think Electrical Prosperity Week 'made good.'" Barker Brothers, large dealers in furniture and household goods, stocked about four times the volume of heating devices which they ordinarily carry for a week, and at the end of Electrical Prosperity Week they had sold out their stock in three different articles.

As a part of the celebration of Electrical Prosperity Week, the electrical interests of Ogden, Utah, held an electric show. Several of the manufacturers of food products in Ogden co-operated with the electrical men, as they realized that it was an excellent opportunity to "tie up" the quality of their products with the feature of electricity in their preparation. There was an attendance at the show of between 8000 and 10,000 people.

Pittsburgh Has Monster Parade

The electrical parade in Pittsburgh was the largest of the kind ever held in that city. There were approximately 3000 men in line, and in addition forty floats, of which number the Duquesne Light Company furnished fourteen, winning first prize, the second prize being awarded the float entered by the Westinghouse Electric & Manufacturing Company. Every electrical contractor, jobber, manufacturer and central station was in line. Upon their return from the parade the Jovians gave an electrical cabaret entertainment and dance in the English room of the Fort Pitt Hotel.

Practically every department store was represented in the parade by decorated electric and gasoline trucks. All were illuminated by electricity. A special section was reserved for electric pleasure vehicles driven by their owners. Beautifully decorated trucks were also placed in line by the electrical jobbing houses, and one of the telegraph companies harnessed fifty of its messenger boys to a float which represented the telegraph industry.

Another activity of Electrical Prosperity Week which proved to be quite popular was the furnishing of speakers on electrical subjects for each of the clubs which hold weekly luncheons in Pittsburgh, namely, the Hungry Club, Chamber of Commerce, Rotary Club, Credit Men, Jovians, Commercial Club, Fellows' Club, and the real-estate men.

Prizes were offered high-school students for the best essays on the uses of electricity and considerable interest was aroused in this manner.

The Week in Missouri

In Kansas City hardware merchants and department stores took advantage of the widespread publicity given to the movement to sell electrical appliances at reduced prices.

A broad co-operation in the campaign was given in St. Joseph by the local business men.

Prizes were given in Joplin for window displays.

The Young Men's Business Club of Springfield arranged in that city a contest for prizes for window displays.

Electrical Christmas for Indiana

The Indianapolis Society for Electrical Development announced that a total of 33,152 persons visited the local exposition during the week. Besides there were the added features of electrical displays in almost every down-town display window.

The men in direct charge of the big electrical display say that an unprecedented demand for electrical devices as Christmas presents at once developed, not only in Indianapolis but throughout the State as well. Many smaller Indiana cities celebrated Electrical Prosperity Week. Every phase of activity to which electricity now has been applied was shown in the exhibits throughout the State, and the stimulus not only to the business of electricity-producing concerns but to the electrical device dealers as well was direct and satisfying. Everybody in Indianapolis is prophesying that Indianapolis and Indiana this year will have the greatest "electrical Christmas" in their history.

In Other States

All dealers in Chattanooga, Tenn., devoted their attention to increasing retail sales, and all report quite a favorable business during the week. The sales of the Chattanooga Railway & Light Company in heating devices and lamps exceeded sales for the previous week by 15 per cent.

Electrical Prosperity Week in Dayton, Ohio, proved to be a very interesting and beneficial week, and it is thought by the electrical interests that it will be the means of both increasing the season's sale of appliances and securing many new customers for the lighting company. Electrical dealers throughout the week featured "Prosperity Week bargains," and they report very satisfactory sales.

A statement from the Tacoma (Wash.) division of the Puget Sound Traction, Light & Power Company says: "We believe that Electrical Prosperity Week has aided greatly the electrical industries."

The electrical interests in Seattle, Wash., feel that the electrical exhibit given there should have been many times larger. Plans are already being laid to repeat the exhibit next year, but on a larger scale.

During Electrical Prosperity Week in Nashville, Tenn., the Nashville Railway & Light Company made a proposition that it would accept house-wiring contracts on a cost basis, while the dealers in the city put special discounts on nearly everything in the market. A large number of new house-wiring contracts were signed, and public interest in the special observance was general.

Electrical Prosperity Week received unusual attention in Reading, Pa. An electrical show was held in the Hotel Berkshire, and all the available space was sold. It is said that every electrical merchant and dealer in Reading was represented in the show in some way. The feature of the week's celebration was the public-interest campaign of the Metropolitan Electric Company. A decorated electric street car daily made trips from the show to the company's power plant without charge to passengers. A keen interest was shown by the visitors to the lighting plant.

About 150 electric and gasoline vehicles participated in the automobile pageant which was the feature of the Washington celebration. Besides the local industries, the federal government displayed much interest by entering many floats. The naval gun factory display comprised ten floats, with everything from a rapid-fire battery fully manned for action up to a 15-in. gun. Sailors in their uniforms accompanied the floats. The Bureau of Engraving and Printing float was equipped with dies from the big plant over by Potomac Park. It showed Uncle Sam producing banknotes. The Government Printing Office also had a good display, a printing press being in operation, with men and women turning out printed matter, in view of the spectators.

The Erie (Pa.) Lighting Company made the week an opportunity to start its Christmas campaign. Each of the six days a special sale on some one electrical device was held at reduced prices.

The Newark office of the Public Service Corporation of New Jersey sold out completely its stock of electrical appliances before the end of the week.

The appliance sales and isolated-plant equipment at the Norfolk (Va.) Electrical Prosperity Week show and at the dealers' stores during the week were larger than

ELECTRICAL KITCHEN IN BOSTON EDISON WINDOW

in any other week in the history of the city, according to E. R. Sutherland, manager of the commercial department of the Virginia Railway & Power Company.

In most of the smaller Kentucky cities the electrical contractors, central-station companies, supply houses and dealers paid special recognition to Electrical Prosperity Week. Practically all of the dealers and others staged demonstrations of one kind or another in their places of business, and paid publicity as well as general publicity was the rule everywhere. The Danville Light, Power & Traction Company offered 60-watt tungsten lamps to consumers who called at the headquarters of the company, not more than ten to a consumer, at 20 cents each for cash. On all the appliances handled by the company a 10 per cent discount was given during the week. The Lambert-Grisham Hardware Company, Henderson, attracted hundreds to its special store demonstration by means of a contest every night in the week, the award in which was an electric iron.

The domestic-science department of the Tulsa (Okla.) high school gave daily demonstrations to large crowds at Tulsa's electrical show.

At Wilmington, Del., the Wilmington & Philadelphia Traction Company demonstrated each day some specialty and offered it for sale at remarkably low prices. A demonstration of an electric toaster was held Saturday, and the device was offered for sale on Monday. On Monday the electric iron was exhibited and offered at attractive price, and so on throughout the week. The showroom of the company and its windows were attractively decorated for the occasion.

Reports from New Castle, Pa., indicate that the Electrical Prosperity Week celebration in that city was a great success. The electrical show was well attended.

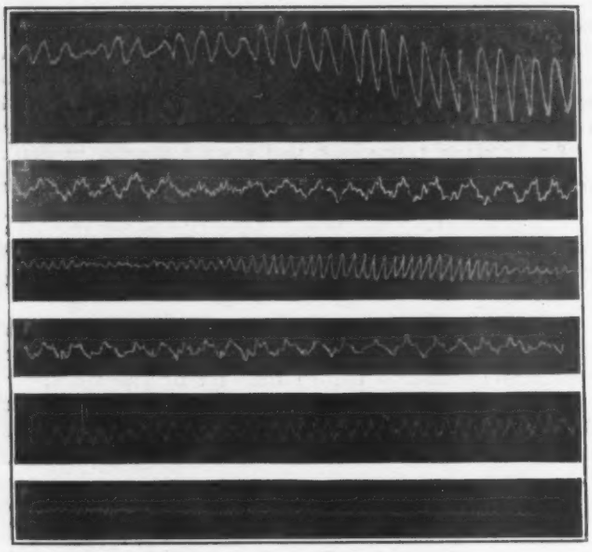


FIG. 1—VIBRATIONS OF A POWER-STATION FLOOR RESULTING FROM OPERATION OF A STEAM TURBINE

A. Vertical vibrations as turbine was started. *B*. Vertical vibrations due to turbo-generator and motor-exciter running under load. *C*. Vertical vibrations due to delivery wagon passing power station. *D*. Longitudinal vibrations due to turbo-generator. *E*. Transverse vibrations 25 ft. from turbo-generator. *F*. Vibrations of boiler-room floor due to operation of turbo-generator.

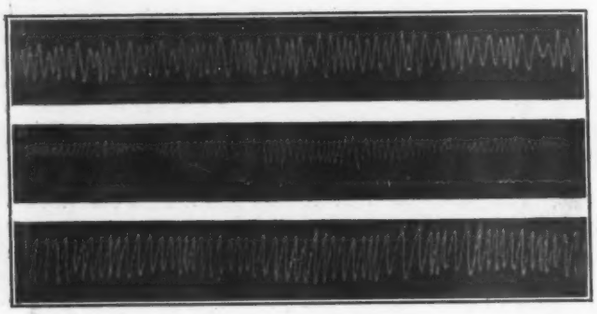


FIG. 2—VIBRATIONS AT FIRST CRITICAL TURBINE SPEED OF 1100 R.P.M. WHILE MACHINE WAS SLOWING DOWN AND SPEEDING UP

A. Vertical vibrations at first critical speed with turbine slowing down. *B*. Transverse vibrations at 1100 r.p.m. with turbine coming up to speed. *C*. Longitudinal vibrations at 1100 r.p.m. with turbine slowing down.

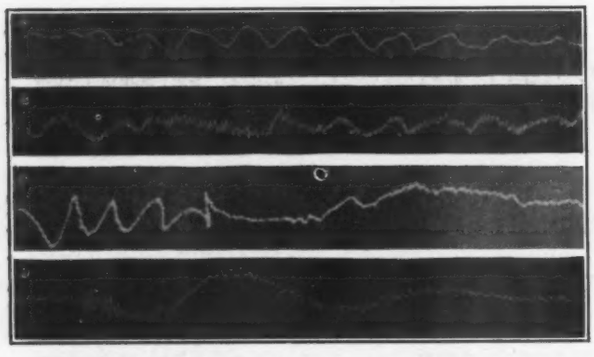


FIG. 3—VIBRATIONS ON STATION FLOOR PRODUCED BY THE STEAM EXCITER WHILE STARTING AND WHILE RUNNING

A. Natural transverse vibrations of building with no machinery moving. *B*. Transverse vibrations twenty seconds later than *A* with exciter running. *C*. Longitudinal vibrations just as steam exciter was started. *D*. Transverse lurch of whole building as exciter was started.

Graphic Analysis of

Investigations with Three-Component Vibration Recorder and Necessity of Mounting Turbo-Generators

By Prof. Elmer E. Hall,

THE vibrations reported in this investigation are those resulting from the operation of a 1000-kw. steam turbo-generator of the horizontal type at 3600 r.p.m. The turbo-generator was mounted on a steel frame above the boilers and condenser, with the boiler floor 10 ft. below the street, the condenser floor 5 ft. above, and the turbo-generator floor 16 ft. above the street level. The steel frame was connected directly to the reinforced-concrete walls of the building and was designed to carry three large generators. Thus far, however, only one has been installed. The building housing the generator has a ground area 48 ft. by 80 ft., with buildings on either side.

The investigation was made with the aid of a three-component portable vibration recorder, patterned after the conical pendulum seismograph. Two instruments were used, one being the same used in previously described investigations,[1] and the other similar to, but of better construction than, the earlier instrument. The two horizontal components and the vertical component are recorded simultaneously on a rotating drum. The records shown in the accompanying illustrations are made on glazed paper, lightly coated with kerosene smoke, and when made are rendered permanent by dipping in an alcoholic solution of white shellac. The magnification may be varied from 8 to 100, and the drum rotated at any speed up to 2 r.p.m. The magnification used, therefore, is not the same on all records, and the drum is not always driven at the same speed. These facts should be taken into account in comparing the illustrations.

Vibrations Within the Power Station

The magnitude of the vibrations on the turbine floor varies greatly with the position chosen, being greatest, of course, near the turbine and directly over the lateral beams supporting the turbo-generator. The vibrations for this particular machine were greater at the turbine end than at the generator end. The machine had been lined up only a short time before the records were made and was in excellent balance. A few feet from the middle of the turbo-generator the double amplitude as recorded was about 1 mm., but owing to the rapidity of the vibrations the recording needle was off the paper much of the time. Near the generator the vibrations were too large and rapid to be satisfactorily recorded with the instruments used. Choosing positions from 25 ft. to 35 ft. from the turbine, and at one side of the supporting beams, satisfactory records were obtained on the turbine floor.

The vertical vibrations as the turbine was started are shown in Fig. 1-A. These vibrations became relatively large, having a double amplitude of 0.06 mm., as the turbine reached a frequency of 12 to 13 per second, this being the natural frequency of the suspended floor. Fig. 1-B shows the vertical vibrations due to the turbo-generator and the motor-exciter regularly running under normal load. There are two frequencies present, the slower one of 12.4 complete vibrations per second (the natural or free frequency of the floor), the faster one of 59 + vibrations per second. This faster vibration is evidently in synchronism with the turbo-generator,

[1] Electrical World, Vol. 60, p. 200, July 27, 1912; *Engineering News*, Vol. 68, p. 198, Aug. 1, 1912.

Building Vibrations

Show Vertical, Transverse and Longitudinal Movement on Independent Foundations Near Ground

UNIVERSITY OF CALIFORNIA

each vibration corresponding to one rotation of the turbine. The double amplitudes of these vibrations are 0.04 mm. and 0.008 mm. respectively. Twenty feet further away, and nearer the wall, these vibrations have decreased to 0.01 mm. and 0.003 mm. respectively. It may be interesting to compare these vibrations with those produced by a delivery wagon on the cobblestone pavement in the street in front of the power station. Such a record, the vertical component of which is shown in Fig. 1-C, was obtained when the turbine was not running. The frequency is 12 per second and the double amplitude is 0.03 mm. The horses were on the trot.

The axis of the turbo-generator is at right angles to the street and parallel to the long dimension of the building. The horizontal-component vibration parallel to the axis of the turbine, and hence parallel to the longest dimension of the building, will be spoken of as the longitudinal vibration, while the horizontal component perpendicular to the axis of the turbine, and hence parallel to the shortest dimension of the building, will be called the transverse vibration. The longitudinal vibrations are shown in Fig. 1-D. Again two frequencies are present, that of the slower being 16.7 per second with a double amplitude of 0.17 mm., the other being of turbine frequency. The transverse vibrations were difficult to obtain owing to their large amplitude and high frequency. The recorder works satisfactorily with large amplitudes at low frequency or with small amplitudes at high frequency, but the recording needles leave the paper with large amplitudes at high frequency. Furthermore, owing to the larger strains involved, the writing arms can no longer be regarded as rigid, and hence the magnification cannot be determined. The double amplitude, as measured, of the transverse vibrations 5 ft. from the turbo-generator, at the position where Figs. 1-A to 1-D were obtained, was 0.6 mm. Fig. 1-E shows the transverse vibrations at a position 20 ft. further from the turbine and more to one side. Again a double vibration was obtained, the slower having a frequency of 13 per second, the same as the vertical at this position, with a double amplitude of 0.04 mm. The smaller vibration, superimposed on the larger, had a frequency of 59 + and a double amplitude of 0.01 mm.

It will be noticed from Figs. 1-B, 1-D and 1-E that the turbo-generator produced two effects as regards vibration—first, a vibration in synchronism with the rotational frequency, and, second, a forced rocking of the building. The latter vibrations are forced because they are not in harmony with the natural or free period of the building. The natural or fundamental frequency of the building when vibrating transversely was 4 per second (see Fig. 3-A), while the forced transverse vibrations produced by the turbine had a frequency of 13 per second. The building was so long in proportion to its height that the natural frequency lengthwise of the building could not be determined accurately. It is approximately 10 per second, while the forced longitudinal vibrations due to the turbine are 16.7 per second. This double character of the vibrations will be referred to later when speaking of the vibrations in the adjacent office building.

This turbo-generator has three critical speeds, at about 1100, 2200 and 3300 r.p.m. respectively, the one at 1100 r.p.m. being the most violent. Fig. 2-A shows

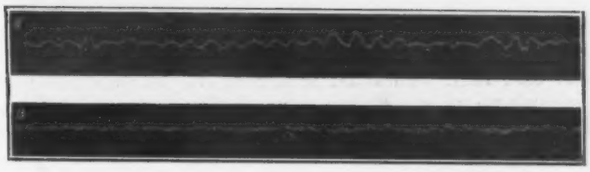


FIG. 4—VIBRATIONS ON FIRST FLOOR OF OFFICE BUILDING ADJOINING POWER STATION

A. Vibrations near wall of first floor of office building adjoining power station. The double character of vibrations is due to frequency of the generator and rocking of the steel-frame supporting turbine. *B*. Longitudinal vibrations corresponding to *A*.

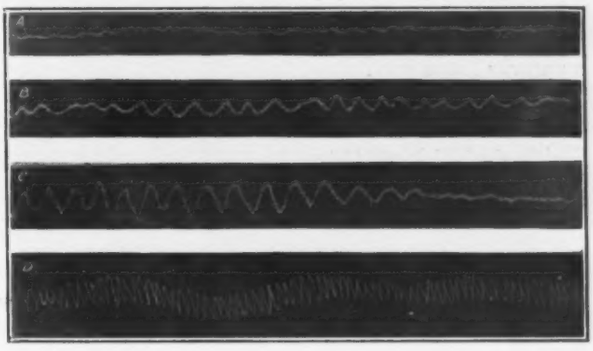


FIG. 5—VIBRATIONS ON SECOND FLOOR OF OFFICE BUILDING ADJOINING POWER STATION

A. Transverse vibrations on second floor with no machinery moving. *B*. Transverse vibrations with turbo-generator running at full speed—note double character of vibrations. *C*. Longitudinal vibrations as turbine is started. *D*. Vibrations due to rocking of steel frame supporting turbine.

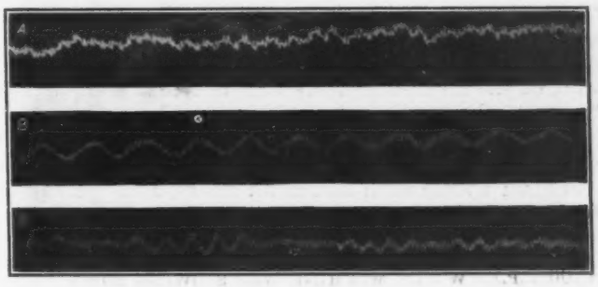


FIG. 6—VIBRATIONS ON SECOND FLOOR OF OFFICE BUILDING ADJOINING POWER STATION AS TURBINE PASSED THROUGH CRITICAL SPEEDS

A. Transverse vibrations as turbine passed through second critical speed—2200 r.p.m. *B*. Vertical component vibrations as turbine passed through second critical speed. *C*. Vibrations when turbine passed through third critical speed—3300 r.p.m.—record taken from same position as *A* and *B*.

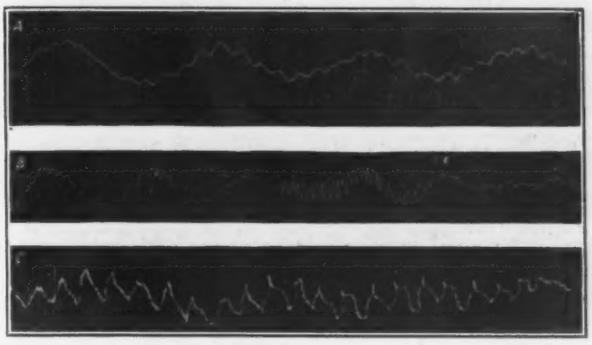


FIG. 7—VIBRATIONS ON NINTH FLOOR OF OFFICE BUILDING ADJOINING POWER STATION

A. Longitudinal vibrations showing swaying of the building as a whole. *B*. Transverse vibrations on ninth floor due to street traffic. *C*. Longitudinal vibrations as turbine passed through first critical speed while slowing down.

the vertical vibrations at the first critical speed, the frequency being 18.5 per second and the double amplitude 0.10 mm. This particular figure was obtained as the turbine was slowing down. Similar results were obtained as the turbine came up to speed. The turbine, however, remains at the critical speed a shorter time when the turbine is coming up to speed. This fact is illustrated in Fig. 2-B, which shows the transverse vibrations at the first critical speed as the turbine comes up to speed. The frequency was nearly 19 per second and the double amplitude 0.98 mm. Fig. 2-C shows the longitudinal vibrations at the first critical speed with the turbine slowing down. The frequency was 18.6 per second and the double amplitude 0.10 mm. It will be noted that the critical speeds are quite sharply marked as regards frequency.

The vibrations produced by the steam exciter or by the motor exciter can be readily measured when either machine is run by itself. The vibrations are, however, masked by the larger vibrations of the turbine under ordinary running conditions. These vibrations are shown in Fig. 3.

Vibrations in an Adjacent Office Building

On one side of the power station referred to is a nine-story steel-frame office building, somewhat irregular in shape, with a ground plan approximately 100 ft. by 160 ft. The walls of the building above the ground level are separated from those of the power station by from 1 in. to 2 in. Below ground the wall of the building is in contact with the adjacent wall and foundation of the power station. The underlying soil is a fine wet sand.

In the basement of the office building, near the wall adjoining the power station, vibrations of the frequency of the turbine are from one-half to two-thirds their magnitude in the basement of the power station. The double amplitude of the longitudinal vibrations is 0.0006 mm., of the transverse vibrations is 0.0012 mm., and of the vertical vibrations is 0.002 mm. The wall next to the power station is in vibration from bottom to top, the effect being greatest at the bottom, decreasing to a minimum at the fifth and sixth floors, and increasing again (probably because of reflection at the top) at the eighth and ninth floors. These vibrations consist not only of the vibrations of a frequency of 60 per second, but also of the slower vibrations due to the rocking of the steel frame supporting the turbine. It should be said, however, that while these vibrations can be felt in some positions, their magnitude is well below the value where any danger to the structure could possibly result.

Fig. 4-A is a record made on the first floor near the wall adjoining the power station, and shows, for the transverse component, the double character of these vibrations. The double amplitude of the vibrations of turbine frequency is 0.0019 mm. Fig. 4-B shows the corresponding longitudinal vibrations, the double amplitude of the vibrations of turbine frequency being 0.0017.

The transverse vibration on the second floor, with no machinery running in the power station, is shown in Fig. 5-A, while Fig. 5-B shows the transverse vibrations two minutes later with the turbo-generator running at full speed without load. The double character of the vibrations is evident. The double amplitude at turbine frequency (60.2 per second) is 0.0016. Fig. 5-C shows the longitudinal vibrations as the turbine is turned on, the double amplitude of the larger vibrations being 0.02 mm. Fig. 5-D illustrates well the vibrations due to the rocking of the steel frame supporting the turbine. The record from which this curve was taken was made on the second floor close to the wall adjoining the power station. The frequency was 13.2 per second and the double amplitude 0.022 mm. It will be noticed that this frequency corresponds with that found in the power station for this component. The drum was not run rapidly enough in the record from which this curve was taken to bring out well the vibrations of turbine frequency. They are, however, discernible on the original record.

The vibrations of turbine frequency, although much too small to be felt, are detected by the recorder on the ninth floor in a room about midway between the front of the building and the wall adjoining the power station. Fig. 7-A shows the longitudinal vibrations at this position. The larger vibrations are due to the swaying of the building as a whole; that is, they show the fundamental vibration of the building. The fundamental frequency for the longitudinal component was 68 per minute and for the transverse component 48 per minute. The maximum double amplitude obtained, with no wind blowing, the effect being due to street traffic, was 0.05 mm. The smallest vibrations observed in the curve are due to the turbine, the frequency being 60.2 per second and the double amplitude 0.001 mm.

For purposes of comparison Fig. 7-B is given, showing the transverse vibrations on the ninth floor produced by street traffic. The vibration is here a tremor with a frequency of 16 per second and a double amplitude of 0.019, followed by a swaying of the building as a whole.

Vibrations produced by the turbine at one of its critical speeds are noticeable, though they are in some cases purely forced vibrations of a different frequency from the speed of the turbine. Fig. 7-C was made on the ninth floor and was obtained when the turbine was passing through the first critical speed with the turbine slowing down. The double amplitude of these longitudinal vibrations is 0.022 mm., but the frequency is 7.2 per second, and not 18.5, corresponding to the turbine. Note the jerky, violent nature of the vibration. The vibration was not felt, the amplitude being slightly below the limit of ordinary sensibility for this frequency. The longitudinal vibrations obtained on the second floor, for both the first and second critical speeds, were similar to those shown in Fig. 7-C. The frequency of the forced vibrations was the same, 7.3 per second, for both critical speeds, although the rotational rate of the turbine was 1100 r.p.m. for the first and 2200 r.p.m. for the second critical speed. The double amplitude of the longitudinal component, on the second floor, for both critical speeds was 0.033, a magnitude which could just be felt. The record for the second critical speed is, however, smoother and less jerky than for the first critical speed.

Interpretations of Results

The amplitudes of all the vibrations given above are well within the elastic limits of building materials, and the accelerations produced are far below the values recognized by seismologists as necessary to produce danger to structure. The seismologists are, however, dealing with larger amplitudes and lower frequencies than are here represented. The amplitude of the displacement for these minute vibrations is doubtless as important in determining the elastic limit as is the time of displacement. Hence the acceleration necessary to produce danger to a structure for these minute rapid vibrations would be as great as for the slower but larger vibrations met with in earthquakes.

The results show the desirability of mounting prime movers low down and of having the foundation of the prime mover separate from the walls of the building. In the type of mounting here investigated not only are the vibrations increased, but both sides of the suspended floor serve as a sounding board, and the noise is greater than it would be if the turbo-generator were on the ground floor.

Electrical Work of the Bureau of Standards

BY FREDERIC NICHOLAS

The Bureau of Standards works in close harmony with the great technical and engineering societies of the country and with the practical engineers who in many lines of applied science are doing the work of the world. It studies the problems of chemistry and electricity and operates a varied mechanical plant working out the problems that vex the industrial manager. Its domain is the scientific world, but it does not enter fields which can be covered effectively by private laboratories. It is a stimulus to the establishment of industrial research laboratories, and it helps our industries to be more scientific.—Statement by Secretary Redfield of the Department of Commerce to the ELECTRICAL WORLD.

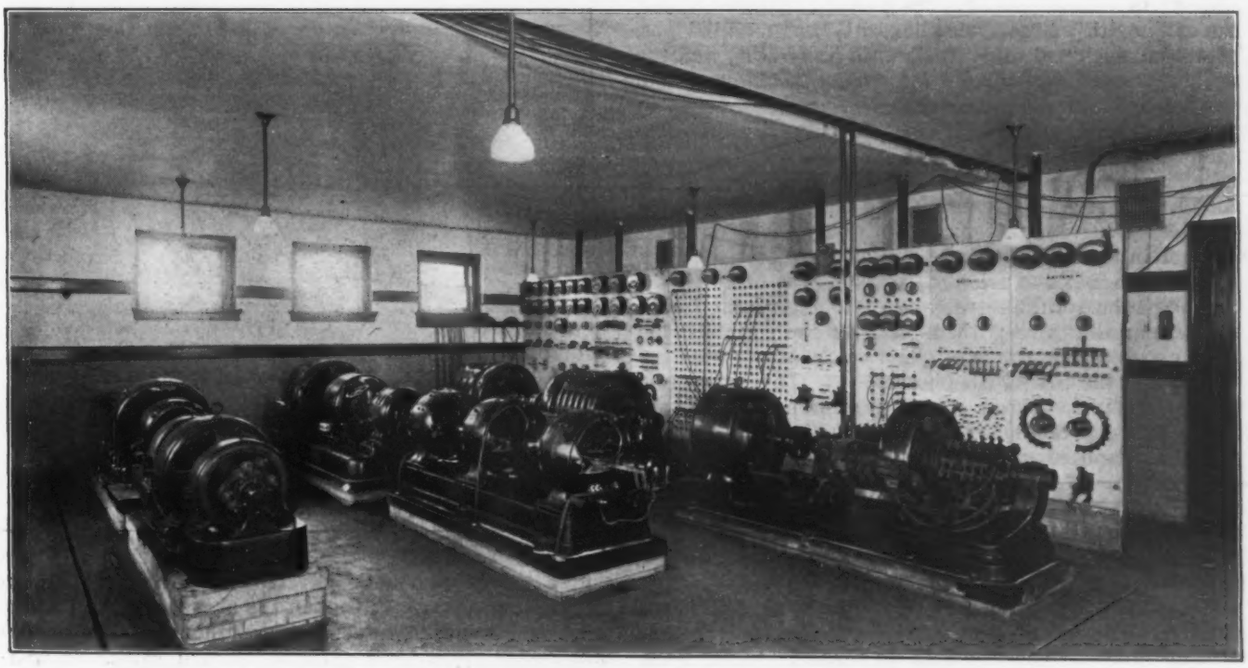
THE investigations by the Bureau of Standards into the standards for the service rendered by public utilities began with the study of gas. When the research work on the subject was started, there was no thought of extending it to other utility services. With the increase in Public Service Commissions, however, and the development of regulative laws requiring state and municipal rules, the officials of the bureau began to give more attention to standards of quality for electric service. Standards of quality are in some respects the most difficult of all standards to determine.

Reports of accidents and requests from State commissions were some of the considerations which led the bureau to undertake the study of public utility questions on the larger scale which is now proposed. The interest of regulative authorities in the work is illustrated by the fact that the initial appropriation for the consideration of safety rules received the warm personal support of one congressman, who stated before the House of Representatives that his action was taken at the request of his State commission.

In addition to acting as the representative of the public commissions in exercising its function in this direction, the bureau also consults with the associations in the industries affected and with representatives of the public utility companies. Thus it endeavors to make its work represent both the regulative requirements of the law and the practical working conditions of the companies that must render a particular service at a definite financial cost to critical consumers. The bureau works under congressional authority, but without statutory authority to enforce its findings. Its aim and purpose is to issue reasonable and practical standards for all who will observe them voluntarily or adopt them as standards for a given jurisdiction.

Although there are several distinct divisions of the work of the Bureau of Standards, the electrical branch has been the leading one since the organization was established. The prominent part taken by the electrical industries when Congress was requested to establish the bureau, and the readiness of many individual engineers to give cordial indorsement to the movement, assured a large measure of electrical activity. Just how strong this support was may be seen by reference to the article on the organization of the bureau which was published in the ELECTRICAL WORLD of Dec. 4, 1915.

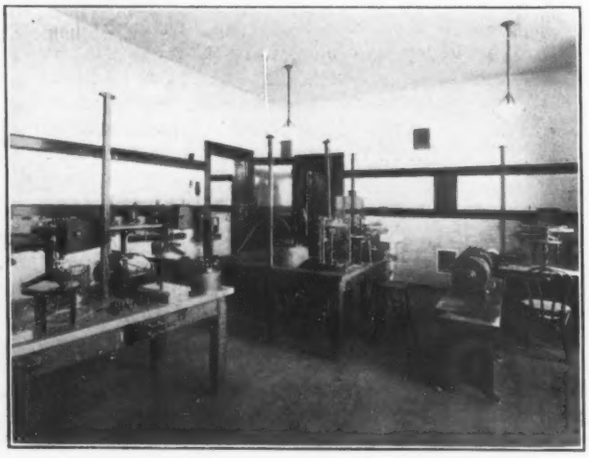
Like the other leading branches of the bureau work, the electrical division has no power to make mandatory standards. Its scientific work is of a research character, and all achievements belong to the public and the industries. The electrical standards of measurement, on which the bureau first concentrated its efforts to promote electrical knowledge, have been developed in close co-operation with the leading technical societies of



DYNAMO ROOM, BUREAU OF STANDARDS, SHOWING SPECIAL MACHINES FOR LABORATORY WORK

this country and with foreign authorities of the highest rank. The position of the bureau as a governmental institution has furthered substantially the recognition by foreign governmental laboratories of work done in this country.

Although a separate laboratory for the electrical division was completed in 1913, ample quarters were provided for this part of the work in the physical laboratory during the early years of the bureau. The physical laboratory, which has long been the headquarters of the administrative force, originally contained among other laboratories those for testing and investigations in electricity, including standards of resistance, electromotive force and induction. There were also laboratories for general research and investigation in connection with measuring instruments, constants and the electrical properties of materials.



LABORATORY FOR MEASUREMENT OF SELF-INDUCTION, MUTUAL INDUCTANCE AND CAPACITY

Organization of Electrical Division

In the first definite plan of organization the work of the electrical division of the bureau was divided into two parts: (1) The construction and verification of resistance standards and standards of electromotive force, the calibration of resistance boxes, Wheatstone bridges, potentiometers and other resistance apparatus, and the calibration of direct-current measuring instruments and resistance standards for current measurement, while, in addition, facilities were provided for the verification of photometric standards; (2) the measurement of electrical inductances and capacities and the testing of inductance coils and condensers and the preparation for alternating-current measurements of a wider range.

Later in the history of the bureau the electrical work was divided into five principal sections, the first dealing with resistance and electromotive force, the second with magnetism, the third with inductance and capacity, the fourth with a wide range of electrical measuring instruments, and the fifth with photometry. Three kinds of work were undertaken: (1) Pure research; (2) the investigation of methods of measurement and of testing, the design and construction of instruments for use in testing, and (3) the testing of instruments and materials for the public and the departments of the government. The broad lines thus laid down years ago have been followed in the substantial progress made by the bureau in the last few years.

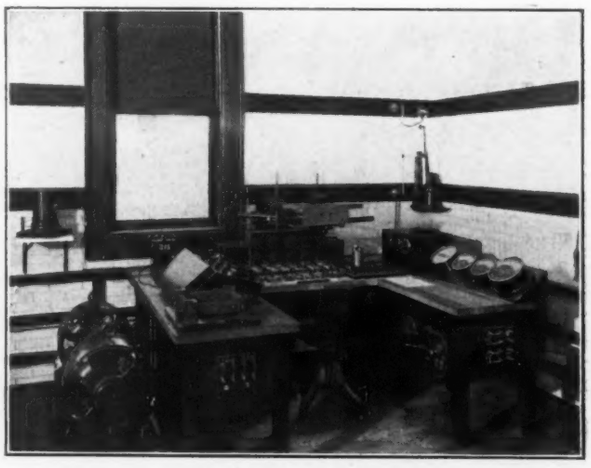
It has been the settled policy of the electrical division, as well as of other divisions, to act in close co-operation with all interests concerned in its results. It has been in touch with the European governmental laboratories and manufacturers and with the private laboratories and the manufacturers of this country. The developments of recent years, including the enlargement of the work to embrace matters of regulation, have been worked out after consultation with the companies directly affected.

Public Utility Researches

No research or investigational work which the bureau has undertaken has aroused more interest than that which has come from its activities in the field of public utilities. This arises partly from the fact that the bureau has no power to enforce standards of quality affecting public service properties, and partly from the great practical importance of the subjects of its investigation. Outsiders have asked why, since it is not specifically directed by law to prescribe such standards, it should draft them for others to use? Inquiries made by the representative of the ELECTRICAL WORLD show that the staff of the bureau has no desire for legal authority to fix mandatory standards, either for public utilities or in any other field. In fact, the members of the staff are better satisfied to continue on the lines of co-operation which they have followed in the past, without statutory power to enforce their findings. They believe that they are getting more satisfactory results by adhering to the policy of developing wholesome relations with both the regulating authorities and the regulated companies.

The extension of the field of work to public utility service was one of the results of the testing of materials for government consumption. In the electrical division the largest item of testing is electric lamps, although it includes many other materials and many types of apparatus. Other considerations which helped to direct the bureau to the study of standards of public utility service were requests for information and advice from public service commissions and reports of accidents. The commissions of various States are directed by law to do what they have neither adequate equipment nor men to do. The Bureau of Standards has a developed organization and equipment for many kinds of work of interest to public service commissions.

To the government officials in charge of the bureau the enlargement of their organization to take up this work appears to be logical and necessary. They feel that the bureau can do effectively what many States would do ineffectively; that in the absence of such work the States would be forced to act without the knowledge that comes alone from careful research work. It was felt, furthermore, that many of the problems are national in scope and can be dealt with best by a national



APPARATUS FOR CORE-LOSS MEASUREMENTS IN SHEET STEEL

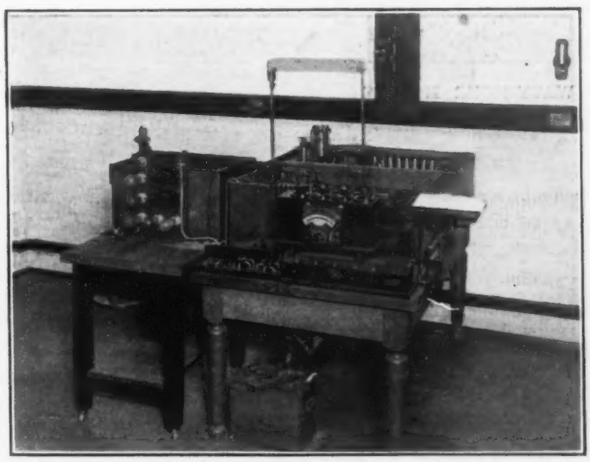
agency like the bureau, acting in consultation with the national associations of utility companies.

Other circumstances which inspired action were the indications that there would be both impracticable requirements and a lack of uniformity if some of the commissions proceeded to enforce the law with the imperfect equipment at their command. So far as the National Electrical Safety Code was concerned, the Workmen's Compensation Service Bureau, representing the casualty insurance companies, was preparing a similar code to govern its inspection work and rate-making, but very gladly gave up the plan when it became evident that the national code would be suitable for its purpose.

National Electrical Safety Code

The National Electrical Safety Code is the most conspicuous work of the bureau in the electrical industry during the last year. Many conferences have been held in all parts of the country in order that the code might not only fully express the regulative requirements of various laws, but also be susceptible of practical application by operating companies. The last conference was held in New York in October, and while it demonstrated that the code is very nearly in shape for publication and use, it also showed the need of further investigation on some subjects before standards can be determined that will meet the varying conditions of different sections of the country. Studies on the subject of stringing wire, the strength of poles and towers, and the relation of strength of construction to weather conditions are under way, and after their conclusion the date for the conference in Washington will be fixed and arrangements made for the approval of the code for adoption for the experimental period of one year.

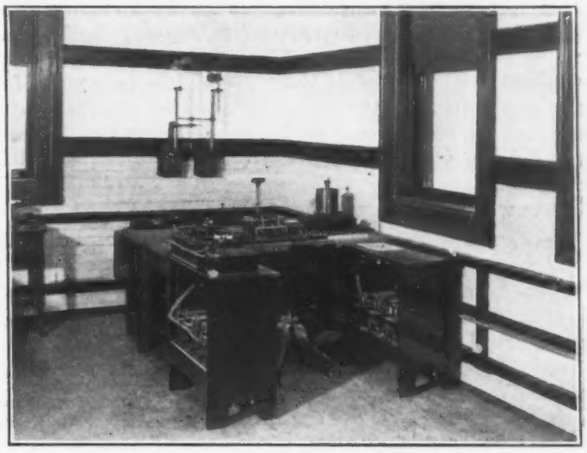
In discussing the work on the safety code, representatives of the bureau say that probably three-quarters of the large companies and one-half of the small companies are doing more in most particulars than will be stipulated by the proposed standards. In some particulars, however, the practices of even these companies will be corrected and improved by the standards recommended. While expensive new construction will not be required in existing stations, additional precautions will be stipulated, such as mats, additional space and guards around



PRECISION APPARATUS FOR USE IN COMPARING RESISTANCE STANDARDS

apparatus, grounding of frames of machines, etc. Even in companies which have the most commendable safety practices, something further may be called for, owing to the fact that variable weather conditions influence the strength and types of construction needed for transmission lines. Before completing the code, therefore, the bureau, in co-operation with the utilities, will investigate more fully the records of actual experience of companies in different districts.

The advantages sought by the safety code, members of the bureau staff say, are perhaps as much in the direction of efficiency and continuity of service as of safety. Many of the small requirements in the code



APPARATUS FOR MEASUREMENTS OF PERMEABILITY OF MAGNETIC SPECIMENS

which will mean little in the way of safety will mean much in the protection of continuity of service.

Standards for Electric Service

The "Standards for Electric Service," which are still under consideration by the bureau, will be issued in tentative form as Circular No. 56, probably early in 1916. The scope of this work may be indicated by a reference to the table of contents, which, of course, is subject to change before publication. Section I will deal with the adequacy and safety of electric service, first historically, then by detailed account of "factors influencing the adequacy of service." Under "central-station operation" will be adequate power and regulation of generating apparatus, switchboard instruments and station records. In "distribution systems" there will be covered voltage regulation of feeder systems, transformer voltage losses and efficiency of distribution. "Energy-measuring services" will include the errors of watt-hour meters and meter installations and tests. "Customers' utilization devices" will embrace incandescent lamps, motors and heating and other devices. "The safety of electric service" will be dealt with in a general statement and in divisions devoted specifically to the grounding of low-potential circuits and to commission jurisdiction and procedure.

Section II will be devoted to meters and instruments. It will give specifications for the approval of types of electricity meters and will take up ampere-hour meters and demand indicators.

Twenty-nine of the State commissions have standardizing laboratories, and Section III will give lists of their equipment.

A classification of rules and regulations for electric service as adopted by State commissions will be published as Section IV. Section V will contain suggested rules for the regulation of such service by a State commission.

In Section VI, "the regulation of electric service by city ordinance," summaries of fifteen municipal ordinances will be given.

Section VII will contain three suggested ordinances for the regulation of electric service in cities, graded, first for towns and small cities, second for cities generally, and third for the largest cities.

Three appendices will contain compilations of the State laws and various pertinent features and data, as well as a bibliography.

Street-Lighting Standards

As an outgrowth of the investigation into service standards, the bureau has begun a study with the object of fixing practicable standards of street lighting. Letters have been sent to various companies and municipalities requesting information as to forms and bases of contracts. Much field work remains to be done before the compilation of the proposed circular on this subject can be undertaken, and probably the results and recommendations will not be given out until the latter part of 1916.

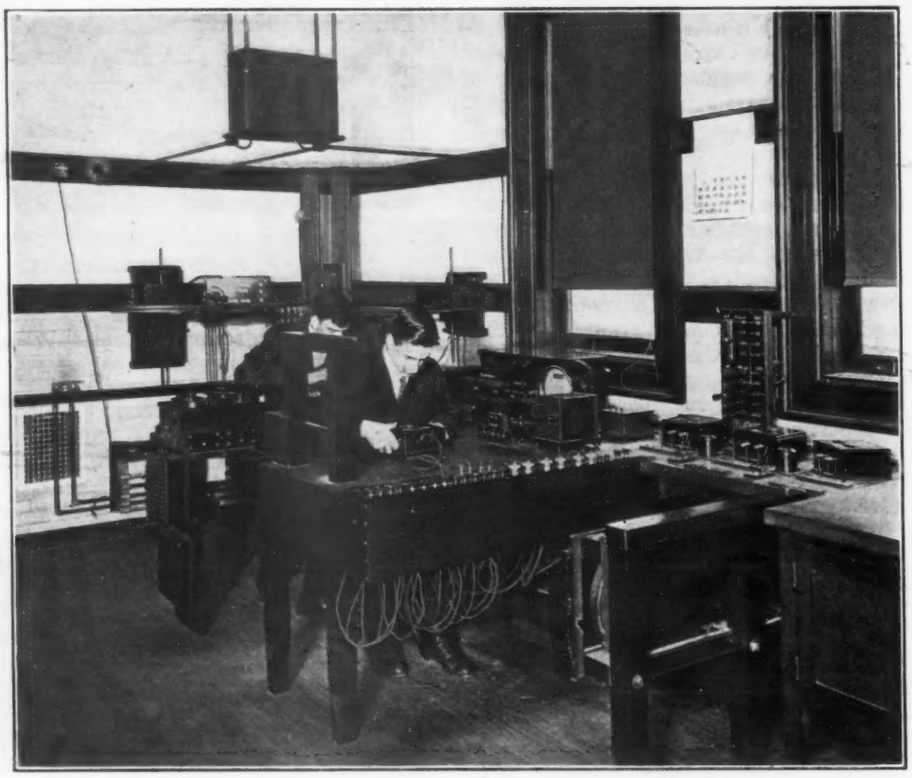
The work of the bureau in the study of the causes and prevention of electrolysis is well known to readers of the ELECTRICAL WORLD. In this, as in all other activities where an individual public service company is concerned, it is the practice of the bureau not to make public a report which contains information as to the business of companies without the consent of the corporations interested.

The appeal to the Bureau of Standards from the decision of the Underwriters' Laboratories relative to a renewable cartridge fuse has been handled by the electrical division. A large amount of experimental work has been done in this connection, testing the various types of cartridge fuses under moderate and severe working conditions. Also inspections have been made in many cities of cartridge fuses of various types in service, and a public hearing was held to which all fuse manufacturers and the public were invited. A decision in the matter will be rendered shortly.

Radio Research Work

The European war has stimulated the radio research work of the bureau, part of which is conducted in conjunction with the Army and Navy Departments. In general, however, the investigations of the bureau are directed chiefly toward measures to promote the safety of life at sea and the safety of navigation. Small radio outfits have been designed for lighthouse tenders. The bureau is engaged upon plans for the design and installation of radio fog-signaling apparatus at lighthouses on important coasts. Similarly, the bureau is urging the equipment of lightships with radio apparatus. One of the contributions to the art of radio communication made by the radio section of the electrical division is the decremeter, which was invented after the passage of the radio navigation law to provide a simple means of measuring directly the logarithmic decrement of wave-lengths.

The bureau is beginning to investigate the question of standards of telephone service, but so far has made only a beginning. It has also made a study of rail bonding and other matters affecting electric-railway service.



EQUIPMENT FOR TESTING WATT-HOUR METERS

Electrical Investigations

Following is a list of the investigations now under way or completed during the last year by the electrical division, in addition to those specifically mentioned above: Weston standard cell, mercury standard ohm, silver voltameter, inductance of electrical resistance shunts, simple method for testing electrical instrument transformers, measurement of earth resistivity, standard air electrical condensers, galvanometers, parallel-decade potentiometer, measurement of conductivity of electrolytes, resistance and inductance of bimetallic wires, magnetic method of determining flaws in steel rails, correlation of magnetic and mechanical properties, magnetic permeameters, temperature coefficient of magnetic permeability, core losses in iron at high inductions, radium testing, alpha-ray activity of uranium oxide powder, radium emanation, radio communication, radio interference, design of inductance coils for radio work, effect of atmospheric conditions on flame standards of candle-power, photometry of lights of appreciable color differences, illuminating engineering, co-operation with the Underwriters' Laboratories, lightning protection.

The Functions of the Naval Consulting Board*

Research and Experimentation Are as Essential and Can Be Made Just as Profitable to the National Government as to Any Industrial Company

BY DR. L. H. BAEKELAND, MEMBER OF THE BOARD

MODERN war, whether it be for robbing, plundering and subjugating other nations or for legitimate self-defense, has become primarily dependent upon exact knowledge, good scientific engineering and, to a large extent, applied chemistry. Germany, with her enormous and well-drilled army, with her 42-cm. guns and other formidable equipment, would be hopelessly paralyzed did she not find in modern chemical processes for obtaining snythetic nitric acid from the air the source of supply of this indispensable chemical. How otherwise could she manufacture smokeless powder and explosives, since England succeeded in shutting her off from the general source of supply—the nitrate beds of the republic of Chile?

DR. L. H. BAEKELAND

The Naval Consulting Board

For those who are accustomed to consider the United States government as a big "milking cow" for salaries and remunerations it may be of interest to know that no member of the Naval Consulting Board draws any salary or gets any remuneration from the government. The general opinion of the members of the board is that its scope of usefulness can best be fulfilled by acting as a "go-between" or a "short-cut" to information between the heads of departments of the navy and any individual member of the different societies they represent. This carries into practice the idea of "mobilization of inventors and engineering talent."

The board mainly puts its service at the disposal of the chief officers of the navy as fast as the latter feel the necessity of co-operation or advice. For instance, a subject relating to improvements in the manufacture or the composition of a certain explosive would be referred to the sub-committee on chemistry and physics, as well as to the sub-committee on ordnance and explosives. The matter would be discussed in these two committees, and their members would decide whom to select among their fellow members of the chemical or engineering societies as best qualified to help them in this task and, at the same time, willing to co-operate without any other compensation than the feeling that they are working for the good of our republic.

The Proposed Laboratory of the Board

The so-called "five-million-dollar laboratory" proposed by the Naval Consulting Board has been a favorite subject of varied and picturesque criticisms which, as usual, originated more through lack of information than from ill-will. Mr. Edison, for instance, pointed out the millions he spent in developing some of the details of his inventions. Another member identified with the automobile industry stated that one single automobile concern here in the United States had found it necessary to spend $500,000 in one year for purposes of experiment and research.

Of course, it was argued that the navy possesses already several experimental stations at its different navy yards and at the torpedo station in Newport, aside from the different testing laboratories for the materials used for ordnance or ammunition, and that, furthermore, the excellent laboratory facilities of the Bureau of Standards are available. The answer to this was that each and every one of the present institutions is more necessary than ever, but that they are totally insufficient; furthermore, the full co-operation of all of them is needed, in view of the fact that at present the navy of the United States is facing responsibilities of a very unusual character.

Postponement of Experimental Work Dangerous

If it be deemed urgent to be prepared for defense, then this defense involves problems the solution of which cannot be deferred indefinitely. If something has to be done, it must be done immediately—not five or ten years hence, when it may be too late.

In all of our present scientific research laboratories time seems of relatively little or no account; problems which cannot be solved to-day can be solved to-morrow or in ten years or during the next generation. But this is not the case with the problems connected with the contemplated defense of our country; the solution of these problems cannot be postponed. They demand immediate action. Nor is the condition of our navy similar to that of an industrial concern that can afford to take chances with machinery or equipment which is not strictly up to date, and still show some commercial success. For instance, recent events have demonstrated that there is no use in building the best and newest fortresses against an enemy who possesses guns strong enough to demolish everything in existence. Nor is there any chance of success in using the very best artillery at anything like equal chances if your adversary can do his scouting and range-finding with aeroplanes provided with reliable engines, while your aeroplanes are equipped with motors which give out at unexpected moments.

In our clumsy war with weak Spain we went into the field with black powder when all other nations, even Spain, were equipped with smokeless powder. Why? Because we had postponed too long studying the chemistry of the subject.

The fact is that if we require a navy at all our navy cannot afford to use anything but the very best and most efficient means of defense. Not to possess the very best might put us in the same absurd condition as the wooden navies of the world were in after our civil war had established the supremacy of the ironclad vessel.

Research Eliminates Inferior Devices

The contemplated outlay for the navy for the next five years, for new ships, aviation and reserve of muni-

*Abstract of an address made at the joint meeting of the New York Sections of the American Chemical Society, the American Electrochemical Society and the Society of Chemical Industry on Dec. 11.

tions, amounts to about $500,000,000. These tremendous expenditures of money, in order to be of real value, ought to be made as efficient as possible. All doubtful and inferior devices must be eliminated by direct experiment, by research and tests, before it is too late to remedy them.

This requires accelerated action; in fact, Mr. Edison's personal opinion was that research and laboratory work in this instance "should go on night and day without intermission," instead of on the usual easy-going short-day plan followed in laboratories.

If one single automobile concern in the United States finds it to its advantage to spend in one year $500,000 on testing, research or experimentation, how much more important is the business of the United States Navy, where money not spent wisely is better not spent at all, because then at least we should not have the illusion that we are equipped for defense, when we have merely lost our money on antiquated devices!

Enormous Damage to Warships Due to Condenser Corrosion

Without mentioning any spectacular problems of modern warfare, it might be stated that such a prosaic detail as the corrosion of condenser tubes of our warships involves an annual damage of about $2,000,000. If $1,000,000 were spent on research on this problem alone, with the result of reducing the damage to one-half, the total outlay would be compensated in a few months' time. Besides, there would be the important fact that our fleet would be stronger because fewer of our ships would be unavailable for immediate active service.

It was brought out that there was little use in spending so many millions on flying machines as long as there was any doubt concerning the reliability of their engines and until an absolutely well-tried and standardized engine had been developed. To accomplish this experimental work in a period of a few years would cost much money, but to do this rapidly, within a few months, before orders are given to build these flying machines, requires enormous outlays of money, in addition to the indispensable engineering talent.

Experimentation Can Be Profitable to Navy Department

Another member of the board brought out the fact that even conservative industrial enterprises found it necessary and profitable to spend at least 2 to 5 per cent of their sales on research and experiments. At this rate, the contemplated expenditure of $500,000,000 in five years would certainly warrant an expenditure of at least $5,000,000 for research during that period. Money for this purpose wisely used ought to do so much good to the navy as to increase its efficiency by the value of several battleships costing considerably more. Mr. Edison's arguments were particularly eloquent when he enumerated the enormous expenditures for research in his own laboratories.

In this discussion everybody seemed to be well in accord with the general idea that whatever expenditures were recommended, the contemplated work should be carried out under immediate supervision of the navy, and that this work should not be started all at once—full blast—but should be extended gradually, as fast as circumstances demand it.

In view of all this, two policies were open for obtaining the necessary appropriations. One was the old time-honored trick of asking from Congress first an appropriation of a few thousand dollars, knowing very well that this would be insufficient, then after awhile asking an additional appropriation, and to keep on nagging and asking at various intervals. But the members of the advisory board thought it a more honest policy to state the facts as they saw them and to confront the Secretary of the Navy with the probable maximum expenses for research and experimentation commensurate with the five years' naval building program now under contemplation.

The five-million-dollar budget for experimental work during those five years, or about $1,000,000 a year, may strike the uninitiated as needlessly large, although it is only about what some industrial enterprises have found necessary to spend on their own experimental work. But if the nation does not want to go to the expense of developing the latest and most efficient means for defense at the lowest cost by obtaining the necessary information through preliminary experiments, instead of committing mistakes on a large permanent scale, or if our country wants its navy to keep on building ships or other means of defense such as were good enough in the past, regardless of the fact that modern war requires the very latest and the most efficient available devices, then let us not be astonished if after incomparably more money has been spent for increased armaments we find that we are loaded with means of defense which have become obsolete in the meantime and are merely good for the junk heap of antiquated equipment.

The foregoing is a brief résumé of various arguments which were submitted by some members of the board, and this is the first time that this discussion has been reported in public. Let us hope that its publication may help to dispel some of the ideas of those who imagine that the board contemplates the immediate erection of a "five-million-dollar laboratory building where the members of the Navy Consulting Board can experiment to their hearts' content in company with long-haired inventors."

As Mr. Edison expressed it picturesquely: "The money should be spent not on buildings, but on a national junkshop," where means of defense can be tried out first, at relatively small cost, so as to learn how to get the most and very best for the money and so as to avoid making expensive and dangerous blunders on a wholesale scale.

More than twelve years ago one of the most distinguished officers of our navy, Admiral George W. Melville, urged strenuously the necessity of naval engineering experiments. His well-based arguments, published in the *Proceedings* of the Engineers' Club of Philadelphia (Vol. XX, No. 3, July, 1903), brought out the fact that expenditures for experiments are the best means for avoiding expensive mistakes. Speaking in glowing terms of the German engineering laboratories, he said in part:

Reasons for Germany's Success

"The success of Germany can be accounted for only by recognizing the fact that study, reflection and research must have been expended in the preparation of the plans, in the building up and the organization of the shipyards, and in laying out and carrying on the work of construction.

"There is probably not an eminent naval or mechanical engineer in America or England who has given consideration to this question who is not also of the opinion that the establishment of a national experimental laboratory for naval purposes will vastly contribute to military strength. Probably the majority of these experts also believe that such an institution would eventually contribute more to actual naval strength than the building of a battleship. One does not need to possess vital imagination to realize that much is contributed to the fighting strength of a navy by carrying on research along engineering lines, and thus preventing the design, construction and installation of appliances that are ill suited for the purposes intended."

West Farms Substation of New Haven Railroad

Transmission and Substation Arrangements in Connection with Furnishing Service to New York, New Haven & Hartford Railroad by United Electric Light & Power Company

THE engineering features involved in connection with the furnishing of energy to the West Farms (N. Y.) substation of the New York, New Haven & Hartford Railroad from the 201st Street generating station of the United Electric Light & Power Company were presented in last week's issue of the ELECTRICAL WORLD. In what follows the transmission arrangements between the generating station and the substation are given, together with the features of the substation equipment and its layout.

Air-Blast-Transformer Grouping at Generating Station

The step-up units at the generating station have structural-iron and sheet-steel housings instead of the cast-iron construction heretofore used, so the floor space required is about equivalent to that occupied ordinarily by the units of one-half the rating. Each of the main 5500-kva. air-blast transformers at the generating station is operated with a 1000-kva. teaser transformer through T-connections. The bank steps up the generator voltage from 6600, three-phase, to a two-phase, three-wire system with 24,600 volts between the outer wires and 17,394 volts between each outer and middle wire. Two low-tension leads and a low-tension neutral are brought out through the top of the main transformer case as well as two high-tension leads and neutral leads. The high-tension neutral is grounded to the case but the low-tension neutral is not. The high-tension neutral is capable of carrying the full current of the winding. The regulation of these units is specified at 11 per cent when carrying 13,750-kva. load at 60 per cent power-factor. Taps are provided to give full-load capacity at voltage 10 per cent above and below high-tension voltages in 2 per cent steps. A separate winding which has a rating of 20 kva. at 210 volts is connected permanently with the air-blast motor so that it will start as soon as the transformer is energized. The inherent reactance of both the main and teaser transformers is approximately 5 per cent, thus preventing more than twenty times rated current on short-circuit.

Connections Between Generating Station and Substation

The connection between the generating station and substation is by means of 350,000-circ. mil triplex cable laid in underground ducts. The bank of transformers to which these cables are connected at the West Farms substation is shown in Fig. 1. The primary windings of these units receive two-phase voltages at a value corresponding to the line drop, namely, 23,000 volts for the main unit and 11,500 volts for the teaser unit. The ratio of the main primary and secondary windings is one to one, so that the secondaries give 23,000 volts across the main phase and a balanced three-phase voltage of 11,000 from the teaser transformer and taps on the secondary winding of the main 5000-kva. unit at the buses in the substation. The output of each of the large air-blast transformers in the generating station is 13,750 kva., and that of substation units 12,500 kva.

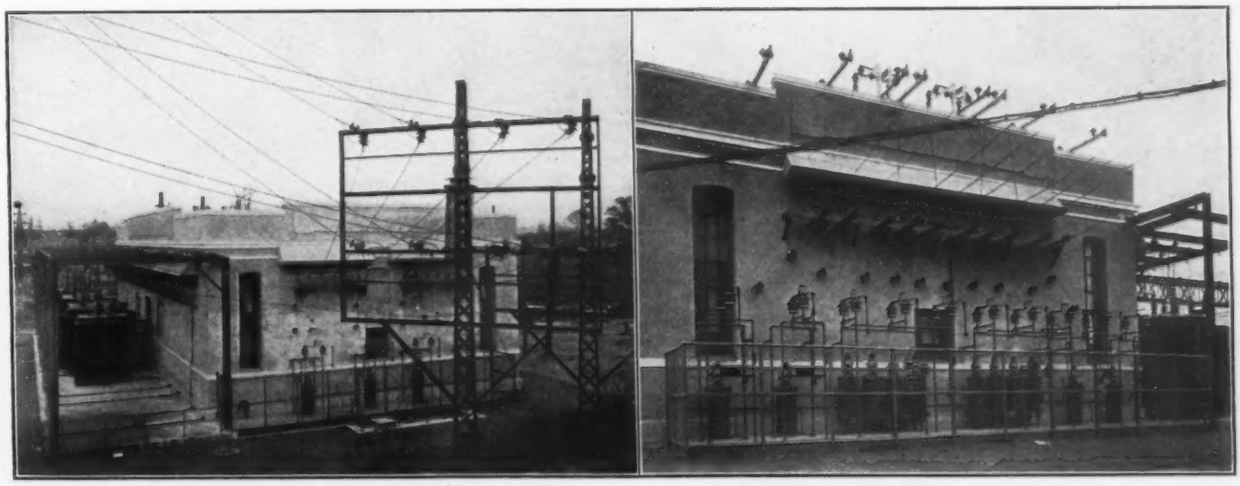
Self-Cooled Radiator Transformers at Substation

Taps are provided on the transformers at the West Farms substation and arranged the same way as on the generating-station transformers to give full rating at voltages 10 per cent above and below the normal high-tension voltages in 2 per cent steps. The low-tension winding is provided with 5750-volt taps on each side of the center to give a balanced three-phase supply from the substation. Each of the main transformers operated in connection with a 1000-kva. teaser unit transforms the energy received from a two-phase system to both a single-phase grounded-neutral 23,000-volt and a three-phase 11,000-volt system. The regulation of these units when carrying a load of 12,500 kva. at 60 per cent power-factor is about 8.2 per cent.

The radiator construction of the self-cooled transformer units at the West Farms substation is an evolution of the tubular oil-cooled construction that is used by the New York, New Haven & Hartford Railroad for auto-transformers of 2000-kva. rating along the tracks of its system. Details of the construction and cooling by natural circulation of oil caused by thermal head or difference of temperature between the oil at the top and bottom of the radiators is explained in detail in the ELECTRICAL WORLD of Feb. 20, 1915.

Substation Layout

The underground cables from the 201st Street generating station of the United Electric Light & Power



FIGS. 1 AND 2—SELF-COOLED TRANSFORMERS AND OUTGOING SINGLE-PHASE FEEDERS; IN ILLUSTRATION AT RIGHT THREE-PHASE LINES ARE SHOWN LEAVING SUBSTATION

KEY TO DIAGRAM, GIVING TYPES AND RATING OF APPARATUS EMPLOYED, ARRANGED IN ORDER ENCOUNTERED IN CIRCUITS AT GENERATING STATION AND SUBSTATION

GENERATING STATION CIRCUITS

From Generators to 6600-Volt, Twenty-five-Cycle Busbars.—Generator, three-phase, 20,000 kw., 6600 volts; generator, O.S., Nos. 9 and 27, 3000 amp., automatic type H-6; bus selector, O.S., Nos. 7, 8, 25 and 26, 3000 amp., non-automatic; disconnecting switches, 3000 amp.

From 6600-Volt, Twenty-five-Cycle Buses Through Transformers to West Farms Cables.—Disconnecting switches, 1500 amp., 6600 volts; bus selector, O.S., Nos. 13, 14, 19, 20, 22 and 23, 1500 amp., automatic; transformer, O.S., Nos. 15, 21 and 24, 1200 amp., type H-3 automatic; main transformers, 5500 kva., 6600/24,600 volts; teaser transformers, 1000 kva., 5720/12,300 volts; ground bus, 4-in. by ¼-in. copper; disconnecting switches, 800 amp., 11,000 volts.

From 6600-Volt, Twenty-five-Cycle Buses to Kingsbridge Station.—Disconnecting switches, 1500 amp.; bus selector, O.S., Nos. 10 and 11, 1500 amp., automatic; one of the other three sets (not shown) is similar and the remaining two are rated at 1200 amp., automatic; feeder, O.S., No. 12, 800 amp., type H-3 automatic; one of the other three sets (not shown) is similar and the remaining two are rated at 500 amp., type H-3.

From 6600-Volt, Sixty-Cycle Busbars to 6600-Volt, Twenty-five-Cycle Buses.—Disconnecting switches, 1200 amp.; bus selector, O.S., Nos. 1 and 2, 1200 amp., type H-3, non-automatic; frequency changer, O.S., No. 3, 1200 amp., type H-3; frequency changer, O.S., No. 18, 1200 amp., type H-3 automatic; bus selector, O.S., Nos. 16 and 17, 1500 amp., non-automatic; disconnecting switches, 1500 amp.

Twenty-five-Cycle Bus Tie and Kingsbridge Tap.—Disconnecting switches, 1200 amp.; tie O.S., Nos. 4 and 5, 1200 amp., automatic; Kingsbridge, O.S., No. 6, 500 amp., type H-3 automatic.

From Sixty-Cycle Buses to Exciter.—Disconnecting switches, 1200 amp.; bus selector, O.S., Nos. 28 and 29, 1200 amp., automatic; exciter, O.S., No. 30, 500 amp., automatic; reactors, 2.5 kva.; exciter set, 250 volts, 200 kw.; generator driven by 7500-volt, sixty-cycle motor.

SUBSTATION CIRCUITS

Incoming Feeders to 23,000-Volt, Single-Phase, and 11,000-Volt, Three-Phase Buses.—Disconnecting switches, 600 amp.; main transformers, 5000 kva., 23,000/23,000 volts; teaser transformers, 1000 kva., 11,500/10,000 volts; mid point of main transformers connected with rails by 500,000-circ. mil cable; oil switches, 600 amp., type E-2, with type CO overload and type C reverse-energy relays; other connections, 0.75-in. copper

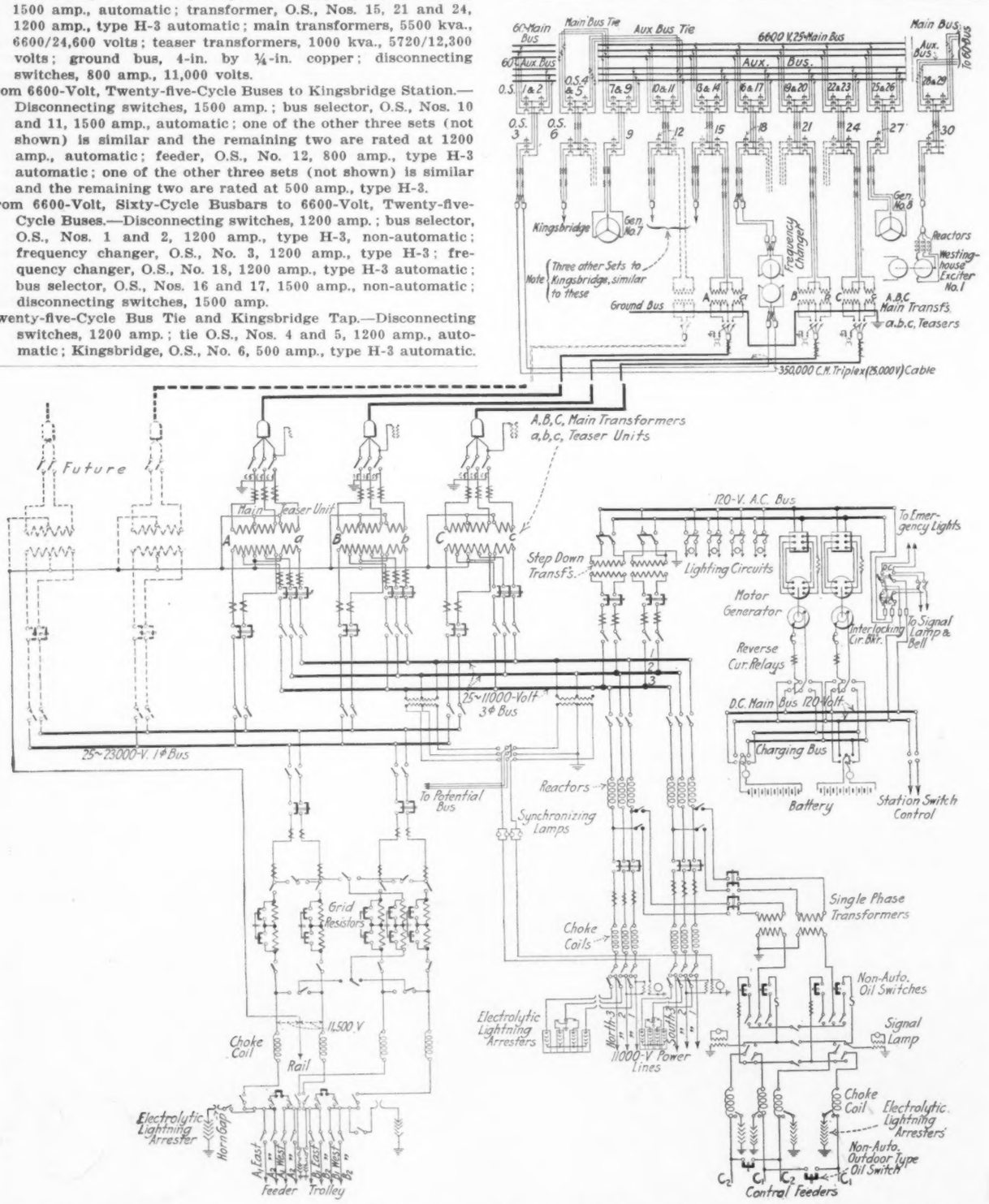


FIG. 3—ARRANGEMENTS OF CIRCUITS IN UNITED COMPANY'S GENERATING STATION AND WEST FARMS SUBSTATION TO HANDLE SINGLE-PHASE LOAD

rods except those feeding three-phase bus, which are 9/16-in. rods.

From 23,000-Volt, Single-Phase Bus to Feeder and Trolley Choke Coils.—Busbars, four 3-in. by ⅛-in. copper bars; disconnecting switches, 1200 amp.; main oil switches, 1200 amp., type O-1 automatic, with type E definite-time-limit relays interlocked with relays on resistor switches; resistor oil switches, 1200 amp., type E-2 automatic with restoring relays; selective relays, type E, operated by overload relay; choke coil, 1200 amp., 11,000 volts; connections, 1.25-in. copper rods.

From Choke Coils to Trolleys and Feeders.—Oil switches, type E-2, 1200 amp.; disconnecting switches, 1200 amp., except those in series with horn-gaps and lightning arresters, which are 300-amp. type.

From 11,000-Volt, Three-Phase Bus to Power Feeders.—Bus, 0.75-in. copper rods; disconnecting switches, 600 amp., except those in series with arresters, which are 300-amp. type; reactors, 200 amp., 6 per cent; connections, No. 0000 solid-copper wires; oil switches, 600 amp., type E-2 automatic, with type CO inverse-time-limit relays; choke coils, 200 amp.

From 11,000-Volt, Three-Phase Bus to Control Feeders.—Disconnecting switches, 600 amp., except those to lightning arresters, which are 300-amp. outdoor type; oil switches to single-phase transformers, 600 amp., type E-2 automatic; connections, copper tube, 7/16-in. outside diameter; transformers, 75 kva., 11,200/11,200 volts; oil switches between transformers and choke coils, 600 amp., E-2 non-automatic, operated by magnet switches energized by pallet switches attached to pallet switches on resistor switches: oil switches between transformers and choke coils, 600 amp., type E-2 automatic, with type CO reverse-time-limit relays; choke coils, 200 amp.

Station-Service Apparatus and Accessories.—Transformers, 25 kva., single-phase, 11,200/120 volts; motor-generator, 7.5-kw., 120-volt generator driven by 12-hp. single-phase induction motor; battery, sixty cells, 60 amp. for one hour.

(The type numbers used refer to Westinghouse Electric & Manufacturing Company's equipment.)

Company enter compartments inside the substation directly back of the transformers shown in Fig. 1. The conductors fan out from pot-heads and connect through disconnecting switches with conductors of ¾-in. solid copper, which lead through wall bushings to a steel structure over the transformer banks. This frame is arranged so that the high-voltage conductors and connections to the primaries of the transformers are supported on pin-type insulators on the top of the frame. The conductors from the secondaries of the transmers are supported from underhung insulators also attached to the steelwork.

From each main and teaser unit a single-phase, 23,000-volt circuit and a three-phase, 11,000-volt circuit are brought into the station and supported on pin insulators from the roof trusses, as shown in Fig. 4. The incoming feeder compartments are shown at the extreme left, the 23,000-volt, single-phase bus and switch compartments next to them, the resistor grids next in order, and some of the 11,000-volt, three-phase switch compartments at the right (the remainder being at one end of the substation). The switches for connecting in the resistors are arranged in one section of the 23,000-volt switch compartment.

The single-phase, 23,000-volt trolleys and feeders leave one end of the station and the three-phase power

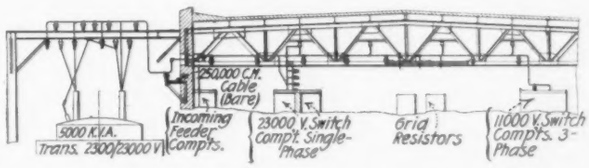

250,000 C.M. Cable (Bare)
5000 K.V.A. Trans. 2300/23000 V.
Incoming Feeder Compts.
23000 V. Switch Compts. Single-Phase
Grid Resistors
11000 V. Switch Compts. 3-Phase

FIG. 4—SECTION THROUGH WEST FARMS SUBSTATION SHOWING RELATIVE LOCATIONS OF FEEDER AND SWITCH COMPARTMENTS AND TRANSFORMERS

and control lines leave the other. All of the power conductors are of solid copper and painted bright red. All connections in circuits consisting of copper rods are made with Dossert connectors. Permanent grounding conductors are provided and connections to the apparatus made through punched lugs pinned and sweated to the copper ground connection. The relay system provided for clearing grounds which may occur on the railway system is described on page 1374 of this issue.

Substation Service

The service from the West Farms substation includes the furnishing of 11,000-22,000-volt, twenty-five-cycle, single-phase energy for train operation and 11,000-volt, three-phase power. The load-factor and power-factor are maintained by agreement at not less than 70 per cent, the former based on the ratio of kilowatt-hours used to that which would be used if the maximum demand were continuous twenty-four hours per day. The minimum demand is set at 6500 kw., with a minimum guaranteed consumption of 40,000,000 kw.-hr. per year.

FIG. 5—END OF SUBSTATION, SHOWING OUTGOING THREE-PHASE LINES AND DOUBLE TIERS OF GRID RESISTORS

Classification of Alternating-Current Motors

With the hope of securing a rational system of classification for alternating-current commutating motors, the ELECTRICAL WORLD, *at the suggestion of the standards committee of the American Institute of Electrical Engineers, opened its columns to present the views of engineers and others on the question. The Aug.* 14 *and Oct.* 30 *issues contained communications from prominent engineers, and our own opinions were set forth in an editorial in the Nov.* 6 *issue. Two other communications are presented herewith.*

Fundamental Types of Single-Phase Commutator Motors

BY W. C. K. ALTES, SCHENECTADY, N. Y.

A CLASSIFICATION of single-phase alternating-current commutator motors satisfactory from a scientific standpoint has been given by E. Arnold in "Die Wechselstromtechnik," Vol. V-2. I hope the translator of this book will find suitable English words for this classification.

Mr. Fynn's energetic attempt to base such a classification on a popular theory instead of on scientific analysis is objectionable in several instances on account of the misconceptions growing out of it.

Mr. Creedy's classification of electromagnetic machinery will doubtless be very valuable to the standards committee of the A. I. E. E. I have not attempted to follow his mathematical analysis, as I have a personal preference for other methods. His conclusions formulated in tabulations seem to me, however, to be perfectly correct.

I believe that the valuable efforts of the standards committee will have the best chance of success if we depart no more than is absolutely necessary from the names now in general use, even if these names have little scientific meaning. For instance, it would seem unwise to try to standardize another name for the well-known induction motor, in spite of the fact that we all know that this motor does not operate merely by

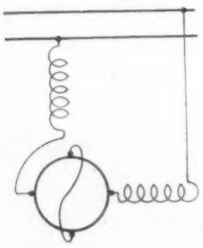


FIG. 48—SERIES-COMPENSATED REPULSION MOTOR

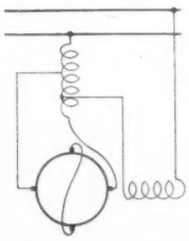


FIG. 49—SHUNT-COMPENSATED REPULSION MOTOR

induction, and that there are many different kinds of electromagnetic apparatus in which induction plays an important part. It would seem to me that the same thing applies to the repulsion motor, and I am glad that Professor Thomson has in these columns called attention to the fact that Mr. Fynn is too critical in his condemnation of this name.

There are four fundamental types of single-phase alternating-current commutator motors from which the others can be derived. If certain names are accepted for these types, then the other motors could be classified by their relation to them.

The fundamental types are:

A. The series motor.
B. The repulsion motor.
C. The compensated repulsion motor.
D. The compensated induction motor.

A. The Series Motor.—In its simplest form the series motor has been shown in Mr. Fynn's Fig. 2. I am glad that both Mr. Fynn and Mr. Creedy recommend the name "neutralized series motor" when this motor is equipped with a neutralizing winding, which seems better than the often-found term "compensated series motor," as we avoid in this way confusion with phase compensation. However, I am sorry that Mr. Fynn makes a distinction between his Fig. 3 and Fig. 4 which is contrary to fact, as the motor of Fig. 4 does not have "rotor excitation." The same applies to his Fig. 6, which is similar to Fig. 5.

B. The Repulsion Motor.—This motor has been shown in Mr. Fynn's Figs. 13, 14, 15, 16 and 17 under different names, most of which seem without any real meaning. His novel name "series induction motor," used for Fig. 14, unobjectionable in itself, does not seem any better than the more common name, "repulsion motor," accepted by Mr. Creedy. I therefore cannot see any good reason for following Mr. Fynn's suggestion on this point.

C. The Compensated Repulsion Motor.—If we add to the ordinary repulsion motor a set of "compensating brushes" displaced 90 deg. with respect to the "energy brushes," we obtain the "compensated repulsion motor." These compensating brushes can be connected either in series or in shunt to the stator winding. We thus get the "series-compensated repulsion motor," C_1 (my Fig.

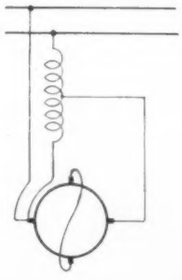


FIG. 50—COMPOUND-COMPENSATED INDUCTION MOTOR

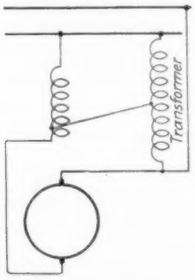


FIG. 51—SERIES REPULSION MOTOR

48) and the "shunt-compensated repulsion motor," C_2 (my Fig. 49). The latter is often called "repulsion induction motor." The "compound-compensated repulsion motor," which is also possible, is to my knowledge not used.

D. The Compensated Induction Motor.—If we omit the field winding of the compensated repulsion motor but retain the polyphase arrangement of the brushes on the commutator, then we obtain a motor which we may arbitrarily call the "compensated induction motor." The brushes coaxial with the stator winding are short-circuited and the compensating brushes can be connected in the same way as explained for the "compensated repulsion motor." We thus have the "series-compensated induction motor," D_1 (Mr. Fynn's Fig. 14), the "shunt-compensated motor," D_2 (Mr. Fynn's Fig. 35), and the "compound-compensated induction motor," D_3 (my Fig. 50).

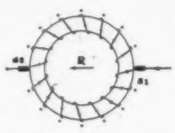


FIG. 1—LEFT HAND GRAMME RING WINDING

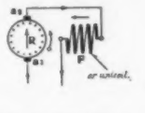


FIG. 2—SINGLE-PHASE SERIES (CONDUCTION) MOTOR

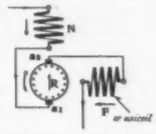


FIG. 3—NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR

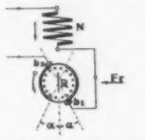


FIG. 4—NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

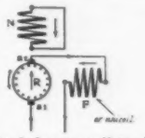


FIG. 5—INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR

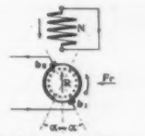


FIG. 6—INDUCTIVELY NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

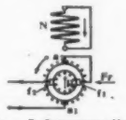


FIG. 7—INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH TWO CONDUCTIVELY RELATED ROTOR CIRCUITS.

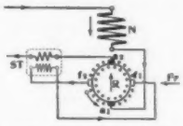


FIG. 8—NEUTRALIZED SERIES (CONDUCTION) MOTOR WITH TWO INDUCTIVELY RELATED ROTOR CIRCUITS

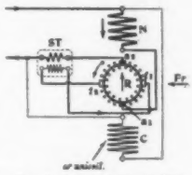


FIG. 9—NEUTRALIZED AND COMPENSATED SERIES (CONDUCTION) MOTOR WITH TWO INDUCTIVELY RELATED ROTOR CIRCUITS

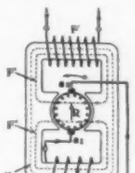


FIG. 10—SINGLE PHASE SERIES (CONDUCTION) MOTOR WITH MIXED (STATOR) EXCITATION

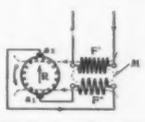


FIG. 11—SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH MIXED (STATOR) EXCITATION

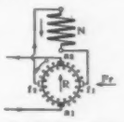


FIG. 12—INDUCTIVELY-NEUTRALIZED AND SELF-EXCITED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

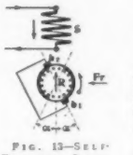


FIG. 13—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

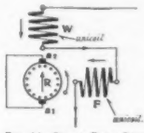


FIG. 14—SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

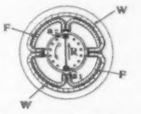


FIG. 15—SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

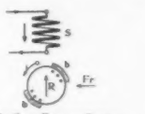


FIG. 16—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND INDEPENDENT BRUSHES

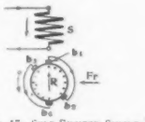


FIG. 17—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO INDEPENDENT ROTOR CIRCUITS

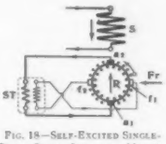


FIG. 18—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO INDUCTIVELY RELATED ROTOR CIRCUITS

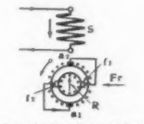


FIG. 19—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO CONDUCTIVELY RELATED ROTOR CIRCUITS

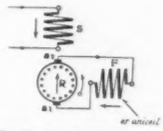


FIG. 20—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

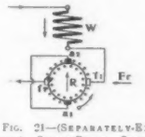


FIG. 21—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

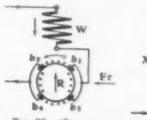


FIG. 22—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

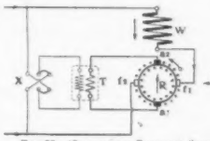


FIG. 23—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION-CONDUCTION MOTOR WITH ROTOR-EXCITATION

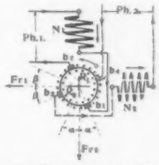


FIG. 25—NEUTRALIZED TWO-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR EXCITATION

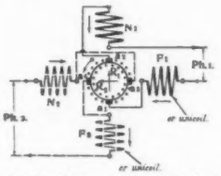


FIG. 24—NEUTRALIZED TWO-PHASE SERIES (CONDUCTION) MOTOR

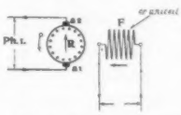


FIG. 26—(SEPARATELY-EXCITED) SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH STATOR-EXCITATION)

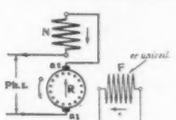


FIG. 27—(SEPARATELY-EXCITED) NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH STATOR-EXCITATION)

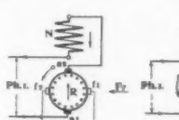


FIG. 28—(SEPARATELY-EXCITED) NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

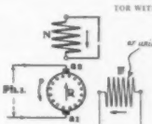


FIG. 29—(SEPARATELY-EXCITED) INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR, WITH STATOR EXCITATION)

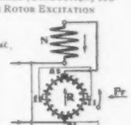


FIG. 30—SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH ROTOR-EXCITATION)

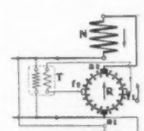


FIG. 31—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH ROTOR-EXCITATION)

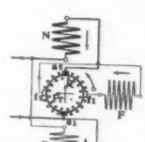


FIG. 32—SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR WITH ROTOR AND STATOR-EXCITATION

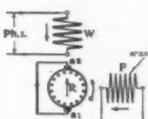


FIG. 33—(SEPARATELY-EXCITED) SINGLE-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

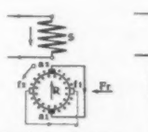


FIG. 34—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH ROTOR EXCITATION)

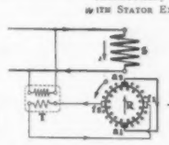


FIG. 35—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH ROTOR-EXCITATION)

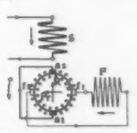


FIG. 36—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION (COMMUTATOR) MOTOR WITH ROTOR AND STATOR-EXCITATION

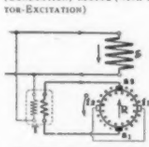


FIG. 37—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION-CONDUCTION (COMMUTATOR) MOTOR (WITH ROTOR-EXCITATION)

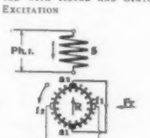


FIG. 38—SINGLE-PHASE SHUNT INDUCTION (COMMUTATOR) MOTOR WITH MIXED (ROTOR) EXCITATION

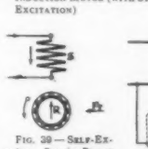


FIG. 39—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION MOTOR (WITH ROTOR-EXCITATION)

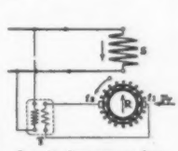


FIG. 40—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION MOTOR (WITH ROTOR-EXCITATION)

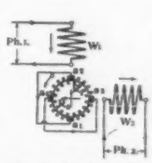


FIG. 41—TWO-PHASE SHUNT-INDUCTION COMMUTATOR MOTOR (WITH STATOR-EXCITATION)

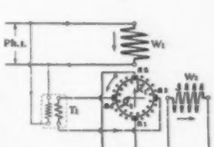


FIG. 42—COMPENSATED TWO-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH STATOR-EXCITATION)

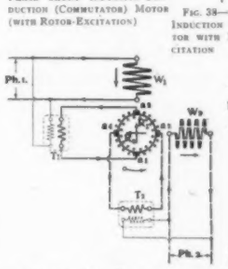


FIG. 43—TWO-PHASE SHUNT INDUCTION-CONDUCTION (COMMUTATOR) MOTOR (WITH STATOR-EXCITATION)

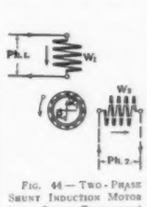


FIG. 44—TWO-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

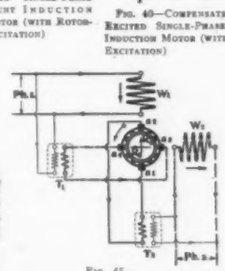


FIG. 45—COMPENSATED TWO-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

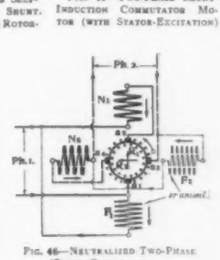


FIG. 46—NEUTRALIZED TWO-PHASE SHUNT CONDUCTION (COMMUTATOR) MOTOR (WITH STATOR EXCITATION)

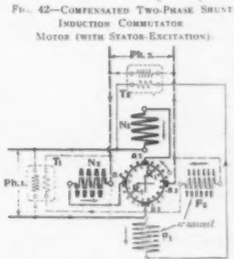


FIG. 47—NEUTRALIZED AND COMPENSATED TWO-PHASE SHUNT CONDUCTION (COMMUTATOR) MOTOR (WITH STATOR-EXCITATION)

CIRCUIT DIAGRAMS OF ALTERNATING-CURRENT MOTORS WITH NAMES SUGGESTED BY MR. FYNN

After having described in this way the four fundamental types in their different forms, we can see how other commercial motors come from the combination of these types. As an example, take the combination of *A* and *B*, the well-known series repulsion motor (my Fig. 51). The combination of *A* and *D* gives the series-compensated series-induction motor (Mr. Fynn's Fig. 23). The other combinations are given in the attached tabulation. Instead of speaking of the "compensated repulsion motor" and the "compensated induction motor," we might speak of the "series and shunt rotor-excited repulsion motor" and the "series, shunt and compound rotor-excited induction motor."

CLASSIFICATION OF SINGLE-PHASE COMMUTATOR MOTORS

A. Series motor.
A_1. Neutralized series motor.
A_2. Inductively neutralized series motor.
B. Repulsion motor.
C. Compensated repulsion motor.
C_1. Series-compensated repulsion motor.
C_2. Shunt-compensated repulsion motor.
D. Compensated induction motor.
D_1. Series-compensated induction motor.
D_2. Shunt-compensated induction motor.
D_3. Compound-compensated induction motor.
AB. Series repulsion motor.
AC_1. Series-compensated series-repulsion motor.
AC_2. Shunt-compensated series-repulsion motor.
AD_1. Series-compensated series-induction motor.
AD_2. Shunt-compensated series-induction motor.
AD_3. Compound-compensated series-induction motor.

A similar grouping would be possible for the polyphase motors, but this I will not attempt at this time. All that I want to show is that it might be possible to work out a classification that adheres closely to the names used in the past.

Classification Based on Restricted Number of Types Unsatisfactory

BY VAL. A. FYNN, ST. LOUIS, MO.

In reply to Dr. Rosenberg's remarks which appeared in the ELECTRICAL WORLD on Oct. 30, I think it would be difficult to select just a few motors for classification, and a classification based on a restricted number of types is sure to prove unsatisfactory. Motors which appear useless to Dr. Rosenberg may seem indispensable to equally well-informed engineers; and if it is desired to evolve a rational and enduring classification, then all the known types should be included. Even now, when the theory of alternating-current motors is well understood, we are forced to the conclusion that the number of radically different types is very great—as fully brought out in my paper.

Although I am quite alive to the importance of commutation, yet I do not see that it has any bearing on classification, and I have, therefore, not made any particular reference to it in my paper on classification.

I think Dr. Rosenberg overlooks the fact that when I speak of an induction motor, with or without a commutator, I have reference to one in which energy is conveyed to the rotor by *static* induction; but, at any rate, he is the first to attempt to define the term "repulsion motor." If I understand Dr. Rosenberg correctly, that term should be applied to all commutator motors in which energy is conveyed to the rotor by static induction, but should not be used in connection with squirrel-cage or slip-ring induction motors, although in these last machines the energy is conveyed to the rotor in exactly the same way. This plan can be followed, but I think it is irrational, first, because it gives to the term "repulsion" a meaning different from that which it has had ever since 1820, and, second, because it is proposed to apply it to only some of the motors having the characteristic features for which it stands. The term "induction motor" is not coined, is exactly descriptive, and avoids all the difficulties I have mentioned.

If the term "repulsion motor" were well defined and generally well understood, I should be more ready to accept it. So far the term has been used indiscriminately. Of course, if Dr. Rosenberg really thinks that it is enough to classify alternating-current motors as induction and commutator motors, then it is useless further to discuss the matter with him.

Dr. Rosenberg's objection to the distinction I make between working brushes, exciting brushes and brushes that carry both working and exciting currents is truly far-fetched. He might as well object to the coil *F* of my Fig. 2, which shows a single-phase series motor, being referred to as a field-exciting coil because of magnetic leakage in consequence of which part of the flux produced by *F* does not do duty as motor field. On this same theory it would also be wrong in case of a badly designed commutator motor of any kind to make a strict distinction between its commutator and an arc lamp. Brushes which in an ideal machine carry nothing but working current are referred to as working brushes; such as carry nothing but exciting current are spoken of as exciting brushes. As to Fig. 16, the currents closing through the brushes do duty as working and as exciting currents, and there are no other exciting currents —hence the distinction I have made. No classification can possibly take into account every commutating current, every Foucault current and every stray field, nor will anyone seriously expect it to do so.

Dr. Rosenberg's objections to my Figs. 3, 4 and 14, 13 are answered in my reply to Mr. Alexanderson (page 973 of the ELECTRICAL WORLD for Oct. 30, 1915). It is, of course, impossible to split up the stator field of Fig. 4 into components when α is so chosen that the vertical-rotor ampere turns are fully neutralized by those of *N*.

What are the objections to my definitions of separate and self excitation?

Defects Affecting Strength of Wooden Poles

The decay of poles before their installation in the line may be of several kinds, and these, with the several kinds of cracks or other injuries, constitute what are known as defects. Since, in designing, the strength of a pole is computed as that of a solid homogeneous cylindrical section, it is evident that pronounced defects may materially affect the actual strength. Therefore either pole specifications and inspection must be strict enough to eliminate poles whose actual strengths are not reasonably close to their assumed values or else a factor of safety must be used to take care of irregularities.

Some detailed instructions to inspectors would seem very desirable, since exactly the same defect may have an entirely different significance in two locations on the pole. Thus a rotten heart, very common in cedar, may be in the center of the cross-section, and therefore of the least effect, or it may be well toward one side. A wood pole is not greatly affected by hollowing out a small portion at the center of the cross-section, but the strength is decreased by any loss of area near the circumference or by any reduction of diameter. The strength is proportional to the cube of the diameter, and the following relative strengths obtain:

15-in. sound diameter	= 1.00
15-in. pole, 5-in. rotten heart at center	= 0.99
15-in. pole, 5-in. rotten heart 2½ in. off center	= 0.89
12-in. sound diameter (1½ in. decay)	= 0.51

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

A VACUUM ASH-REMOVAL SYSTEM

How Ashes Are Handled in a Small Plant—Construction and Operation of the System

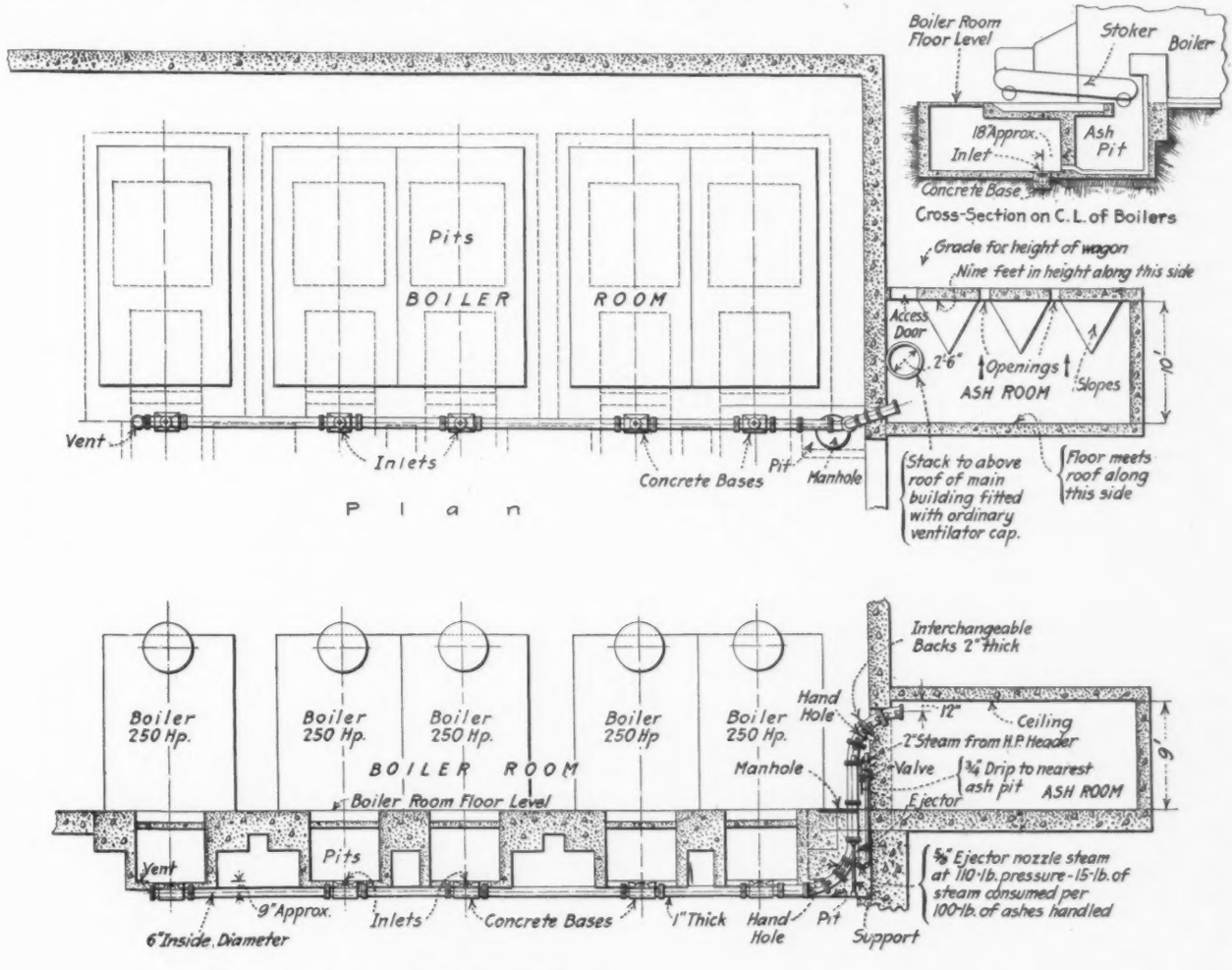
BY T. W. REYNOLDS

The system of piping used for the removal of ashes under fire-tube boilers and stokers rated at 250 hp. each in the power house of the Missouri State Capitol, Jefferson City, Mo., is shown in the accompanying illustration. In the operation of this system the ashes are raked forward from the ash pits to the inlets of the horizontal pipe line shown on the plan and section drawings in front of the boilers. The inlets to this pipe line are inclosed in concrete bases and open upward into the ash pits. From these points the ashes are conducted by suction through the pipe to the ash room.

The ash room is built of concrete, 10 ft. by 20 ft. in size, 9 ft. in height on the delivery side, and provided with a floor which slopes upward to the roof at the other side. The sides of this ash room are sloped so that delivery of ashes can be made through openings over wagons at a grade below equivalent to the height of the wagons. Sections through this room are shown below.

The pipe which discharges the ashes enters the ash room about 1 ft. below the roof and is turned at an angle, as shown in the elevation drawing. The vacuum in the ash-delivery line is produced in the riser section by the injection of steam at a pressure of 110 lb. through a $\frac{5}{8}$-in. nozzle and ejector fitting. Steam at lower pressures may, however, be used. Fifteen pounds of steam are condensed for 100 lb. of ashes handled with a nozzle pressure of about 110 lb.

The delivery pipe is of special chilled iron selected to withstand the abrasive action caused by rapidly moving ashes. The straight run of the pipe is of 6-in. inside diameter with a 1-in. thickness of metal. The radii of the bends at the discharge end are 4 ft. to the center of the pipe and made up of 22½ deg. units or elbows. The backs of these are interchangeable, since these are points of wear, and reinforced by 2-in. thickness of chilled material designed to withstand the wear due to conveying at least 4000 tons of ashes.



LAYOUT OF AN ASH-REMOVAL SYSTEM INSTALLED IN THE POWER STATION OF THE MISSOURI STATE CAPITOL, JEFFERSON CITY, MO.

The elbows and ejector nozzle below the floor are installed in a pit accessible through a manhole in the boiler-room floor. Hand-holes are placed in elbows as shown, one on the inside radii of each bend. A steam-control valve is placed above the floor on a 2-in. line which connects to the high-pressure steam header. The vertical steam drop is provided with a ¾-in. drip pipe and valve at a point above the control valve which leads to the nearest ash pit. A support for the riser is required and is installed as shown in the diagram.

The system is vented at the beginning of its run in the first ash pit and also by a stack 30 in. in diameter installed over and opening into the ash room well back from the wall against which the ashes impinge. With this arrangement little dust is blown into the outside atmosphere. The access door of this room is near the main building wall for the same reason. The stack is provided with a ventilating cap at a point slightly above the roof of the main building. This ventilator is merely an outlet for the injected steam and is made of a size sufficient to reduce the velocity of escape and eliminate dust. No movable or special ventilators are needed.

The cost of handling ashes by means of this system has made its operation attractive aside from the low installation cost and maintenance due to absence of mechanical parts.

PROTECTING TOWER LINES FROM SLEET

Nature of Damages Resulting from Sleet Storms—Recommendations for Designing Transmission Lines in Sweden

By Torsten Holmgren*

In connection with the comment on tower-line protection against sleet which appeared in the issue of the Electrical World for Oct. 9, 1915, the writer recounts some experiences at the Royal Trollhättan power works in Sweden with sleet and snow load and the consequent directions given by him for the designing of the transmission lines.

It is evident that during a sleet storm the first damage that is likely to occur on the system is a short-circuit between line wires caused by uneven ice load. If the different wires receive a different load of ice, as is always more or less the case, first, the difference in sag especially with the use of long suspension-insulator strings rapidly grows with the ice load, and, second, with a constant wind pressure from the side, the angle of the wire with the vertical plane grows with the ice load to a certain maximum, depending on the area and specific weight of the wire and the ice. If the specific weight of the ice is 0.5, a copper wire has its maximum of movability for wind with an ice cover of a diameter equal to 4.12 multiplied by the wire diameter. At a much larger ice load than this, the difference in angle between a loaded and an unloaded wire is still of great importance. For instance, a 70-sq. mm. (138,100-circ. mil.) stranded copper wire with hemp core will, without ice load, swing to an angle of 29 deg. at a wind pressure of 50 kg. per square meter (10.2 lb. per square foot) and go out to a maximum of 44 deg. 40 min. at the same wind pressure if loaded with 0.55 kg. ice per meter (0.36 lb. per foot) length, the specific weight of the ice being 0.5. At an ice load of 1.5 kg. per meter (1.0 lb. per foot) the angle would still be 41 deg. 20 min. If we now investigate how the sag changes with the ice load, we find that on a span of 200 m. (656 ft.) long and 7.10 m. (23.2 ft.) normal sag at zero temperature, the sag of the wire mentioned, if pin insulators are used, increases to 7.45 m. (24.4 ft.) at 0.55 kg. per meter (0.36 lb. per foot) ice load and to 8.10 m. (26.6 ft.) at 1.5 kg. per meter (1.0 lb. per foot) ice load. If suspension-insulator strings of 1.35 m. (4.4 ft.) long are used, the sag under the same conditions will increase up to 10.23 m. (33.6 ft.) and 13.0 m. (42.7 ft.) with the assumption that all the spans to the next strain towers are free from ice. It is easy to show by diagrams that with pin insulators short-circuits through ordinary sleet and wind are entirely avoided with a judicious choice of span length and distance between wires. If long suspension-insulator strings of the common type are used, the case is different.

If a short-circuit happens under such conditions, it is very probable that one or two wires will burn off. The adjacent towers are then exposed to a serious torque through the ice load and wind pressure on the same wires in the adjoining unbroken spans. If the wires have a triangular arrangement, for instance, and at least two of them are on long cross-arms or supports, the tower must be of still heavier construction to withstand such extreme conditions.

On a new line very careful investigations were made, showing a decided economical advantage for the flexible tower system over the non-flexible, both designed—with one strain tower per kilometer (3281 ft.)—to stand 1.0 kg. ice per meter (0.67 lb. per foot) wire at 37.5 kg. per square meter (7.67 lb. per square foot) wind pressure and a safety factor of 4, the latter reduced to 1.9 if two wires burn off. If the line is not designed for such eventualities, grave damage may ensue.

In order to prevent short-circuits of this kind, especially on the suspension-insulator-lines, in the Trollhättan plant, a special arrangement was made in order to melt the ice or snow from the wires. For this purpose one of two parallel lines (at first on the wind side of the towers) is taken out of service. The three wires are connected at the receiving end to each other, and a heavy current of generator pressure is sent out on the line. If the temperature is about zero, the ice or snow comes down easily. The current and pressure needed can easily be calculated.

As conclusions from the above considerations the author advises the following means for the protection of important main lines against sleet havoc:

1. Provide an arrangement in the power house to melt away the ice with electricity as soon as possible.
2. Design the line for the worst combination of ice and wind known in the particular locality, with a reasonable safety factor, and take into consideration that two wires on the same span possibly come down at a short-circuit.
3. Consider that the risk from combined sleet and wind is much greater with suspension insulators than with pin insulators, as the sag on the former line is dependent on the load on adjacent spans.
4. Carefully investigate the influence of span length, distance between wires and place of insulators on the possibility of short-circuits through ice and wind.

It is evident that the modern suspension-insulator string is not an ideal arrangement from this point of view. It is to be hoped that this fact will be considered in future development of this insulator type.

The author proposes that statistical data concerning sleet and wind from all countries be gathered and published. Sleet storms are very rare in certain parts of the world, and of course it is a very difficult and tedious work for an individual to ascertain the worst conditions to be expected. Even incomplete world statistics would certainly be of great value to power-distributing systems. Since engineering corporations are not organized as international co-operating institutes, probably the only way to gather this information is through private contributions from observations and data collected by engineers in different sections of the world.

*Consulting engineer, also general manager and chief engineer Royal Trollhättan Power Works, Trollhättan, Sweden.

How 334 Ft. of Jute-Covered Cable Stuck Fast in Tile Duct Was Removed

BY E. R. MARTIN

Underground cable operators may be interested in a method recently used by the Des Moines (Iowa) Electric Company for removing two lengths (334 ft.) of jute-covered 1,000,000-circ. mil cable that had become stuck fast to tile duct. In attempting to pull out this cable two wire cable grips were broken and a 9/16-in. guy wire was found too weak to stand the strain. The tar which had run out of the jute during repeated heatings had evidently glued the cable fast to the duct. Some method besides pulling had to be resorted to in order to loosen the cable.

The most reasonable means was to heat up the tarred jute, which could be easily done by passing current through one cable to the next manhole, letting it return on the other cable. Either the lead sheath or the copper or both could be used as the conductor. The lead sheath was found by calculation to have about sixteen times the resistance of the copper conductor. The same heating could therefore be done with one-fourth the current and four times the voltage by using the lead sheath. Direct current was available at 115 volts, regulated by water-box control or from a pipe-thawing transformer. The latter was chosen as being the most feasible for the location. A preliminary calculation to determine the approximate length of time required to heat the cable, assuming all heat stored in the lead, showed that the temperature would rise 60 deg. C. in ten minutes, using 5 kw. for each cable length.

The lead sheaths of the two cables were finally looped into a return circuit and the current was applied, using 290 amp. The first length was loosened in twenty-five minutes. The next morning the other piece was pulled after twenty minutes' heating, using the lead sheath with copper return.

Service-Wire Entrances to Western Irrigation Pump Houses

The accompanying illustrations show a type of the pump-house construction used for irrigation pumping installations by the Southern Sierras Power Company. In Fig. 1 the service wires from a pole are shown at the point where they enter the cupola of the pump house. The cross-arm construction at these entrance openings is more clearly shown in Fig. 2 for both frame and concrete buildings. After entering the structure the service lines continue to "Noark" boxes and connect through a standard overload relay, meter and starting box to the motor. The wiring between the starting box and the motor is installed in conduit. Potential and current transformers are mounted on the back of the panelboard shown in Fig. 1 for use in connection with a polyphase watthour meter.

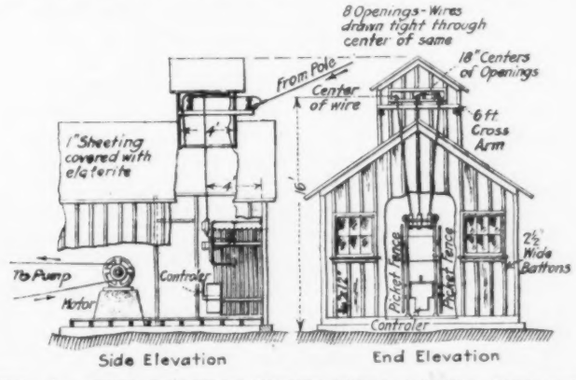


FIG. 1—TYPE OF PUMP HOUSE WITH CUPOLA USED BY SOUTHERN SIERRAS POWER COMPANY

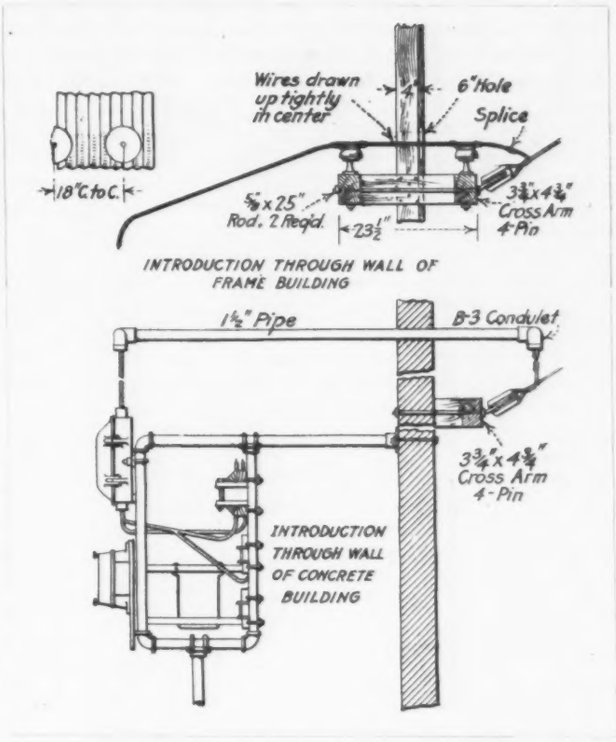

Wires drawn up tightly in center
6" Hole
Splice
18" C. to C.
5/8 x 25" Rod. 2 Req'd.
23½"
3¾ x 4¾" Cross Arm 4-Pin
INTRODUCTION THROUGH WALL OF FRAME BUILDING
1½" Pipe
B-3 Condulet
3¾" x 4¾" Cross Arm 4-Pin
INTRODUCTION THROUGH WALL OF CONCRETE BUILDING

FIG 2—LINE-WIRE ENTRANCE ARRANGEMENTS WHEN CUPOLA IS USED AND WHEN IT IS NOT USED

The panelboard frame is constructed of 2-in. pipe, and placed at one end of the building approximately 4 ft. from the wall. Access to the wiring and coils at the back of the meter is prevented by the use of a picket fence, as shown in Fig. 1.

The cupola design of pump house has been found desirable in most cases. However, where there is sufficient clearance between the roof and the top of the panelboard, the customer is permitted to bring in the service wires through the gable end of the building in conduit. All installations are made with service wire in conduits, and the loop connecting the service entrance and the poles of 6600-volt cambric-insulated wire. The majority of pump houses constructed in the territory served by the Southern Sierras Power Company are of sheet iron. It has been found that this type of construction is preferable on account of durability, ease of construction and lower first cost.

The pump house is installed by the consumer at his own expense, and all wiring is made in accordance with regulations of the engineering department of the company. The wiring is grounded for the protection of the operator.

How Improved Voltage Regulation May Show Profits

BY S. G. HUNTER

In the issue of the ELECTRICAL WORLD for Oct. 23 an editorial entitled "Practical Voltage Regulation" treated the subject from the viewpoint of service to the consumer. It would seem to the writer that the matter might be treated equally well with regard to the benefit which normal voltage on the system affords a central-station manager.

Very often the central-station engineer knows that the voltage regulation of a part, and perhaps all, of the

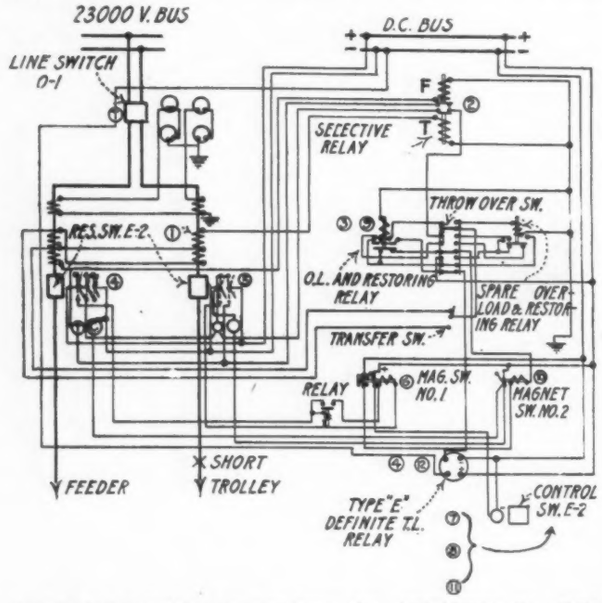
system is very poor, but since there is no complaint from the consumer nothing is done to remedy the situation and a considerable percentage of the proper income of the station is continuously lost—a fact which is almost, if not quite, disregarded. Naturally, it is at the time when the feeders are carrying the maximum loads that the voltage drop is most felt and, therefore, it is then that losses due to low voltage should be considered.

The average load records show that the lighting peak has a duration of about two hours per day for each day of the year, so that this figure may be used as a basis for calculations. In the case of a single feeder carrying a lighting load of 200 kw. it may safely be said that the average voltage drop at the time of maximum load is 4 per cent. The reduction in the amount of power supplied which corresponds to this lowered voltage is 6.3 per cent. A tungsten lamp load is assumed, carbon lamps causing an even greater reduction. From these figures it will be seen that the yearly loss due to this condition at 10 cents per kilowatt-hour will amount to $(2 \times 365 \times 200 \times 0.063 \times 0.10)$, or $919.80.

A proper survey of a system may show that practically the same condition exists on many, if not all, of the feeders, especially those where the load has been steadily increasing for a few years. Moreover, it will probably be discovered that a comparatively small investment for automatic-feeder voltage regulators will divert a great percentage of this drain again into the coffers of the central station. The installation of feeder-voltage regulators on the circuits will, over and above this benefit to the central station, also be of value to the consumers because the service which they receive is so materially bettered.

Relay System for Clearing Grounds at Railway Substation

An interesting relay system is used at the West Farms (N. Y.) substation of the New York, New Haven & Hartford Railroad for quickly clearing grounds that may occur. The sequence of relay and switch



INTERCONNECTION OF RELAYS AND SWITCHES TO CLEAR GROUNDS AUTOMATICALLY

operations is indicated by numerals in the accompanying illustration. With a short on the trolley (indicated by the cross): (1) The double-ratio current transformer energizes its corresponding coil of the selective relay and also the overload and restoring relay. (2) Current passing through the lower coil of the selective relay separates the lower contacts, thus selecting the feeder switch to be tripped. (3) At the same time the overload and restoring relay closes the upper-contactor circuit of the selector relay, actuating the trip coil of the feeder-resistor switch and energizing the type E definite-time-limit relay. (4) When the resistor switch opens, the pallet switch is thrown into the dotted position, energizing the trip coil of the trolley-resistor switch. (5) The latter on opening throws the pallet switch into the dotted position, energizing magnet switch No. 1. (6) On operating, this switch closes its contactors, as shown by dotted lines, thereby preparing the coil of magnet switch No. 2 for energizing current and letting energy flow through the closing coil of the bridge-control oil circuit-breaker. (7) On closing, the control switch energizes the bridge-control circuit. (8) The bridge switch, if still overloaded with the resistors in series, then opens and removes the "short." (9) When the ground is cleared the contact bar on the overload and restoring relay drops onto the contacts, energizing magnet switch No. 2. (10) This in turn moves its contactor into the dotted position, thereby closing both of the resistor switches. (11) Simultaneously with the closing of the resistor switches the bridge-control switch opens and normal conditions are restored. (12) In case the short remains and the bridge switch fails to open, however, the definite-time-limit relay energizes the tripping coil of the type 0-1 line circuit-breaker, opening same, in which case it has to be closed by hand.

An Inexpensive Substitute for a Set of Feeder Ammeters

By Clifford W. Bates

The various buildings of the Sheffield Scientific School of Yale University obtain light and power from an isolated plant consisting of two 100-kw. units supplying direct current at 230 volts by a three-wire system. There are nine three-wire feeder circuits leaving the switchboard, and until about three years ago there was no way of measuring the load or of determining the balance of an individual three-wire circuit except to estimate the load or to open the feeder switch and note the effect on the generator ammeters. Naturally this latter method was used only in extreme cases, and some more convenient method of measuring the feeder currents was desired. It was out of the question to install individual feeder ammeters, on account both of the cost and of the space required.

In the accompanying illustration the writer shows how the problem was finally solved. Eight of the nine circuits were fused on the back of the board, and a piece of cable about 2 ft. long was used between the fuse studs *B* and the switch studs *A*, as in Fig. 2. The ninth circuit was installed after the others and had a fused switch, but included about 4 ft. of cable between the busbars and the switch. These sections of cable were used as ammeter shunts, as indicated for one of the circuits in Fig. 2. Eighteen non-polarized Hubbell plug receptacles were mounted on a wooden board at the end of the switchboard and arranged in two vertical rows —for positive and negative sides of the circuits respectively—and were connected to the sections of cable which were to serve as shunts. A millivoltmeter was connected to a plug which could be inserted in any desired receptacle, enabling the current in either side of any circuit to be measured.

The connections from "shunts" to receptacles were made with No. 18 B. & S. rubber-covered fixture wire.

Connection was made with the terminal lugs at the ends of the shunts in one of two ways—either by slipping a thin sheet of copper, to which the lead was soldered, under the nut on the stud bolt holding the lug or by drilling and tapping the lug to take a small machine screw, under the head of which the shunt lead was fastened.

Calibration was effected by plugging a standard ammeter into each circuit in turn in place of a fuse. Plugs for this purpose were made from the ends of a blown fuse. Corresponding readings on the portable millivoltmeter, which was used with the arrangement at first, and on the ammeter were noted for each side of each circuit, and from these readings factors were obtained by which the current could be calculated. The arrangement was used in this form for about a year and was perfectly satisfactory as far as it went, but it had the great disadvantage of not being direct-reading. Since considerable use was made of this "ammeter," it was thought worth while to obtain a switchboard millivoltmeter and to adjust all the shunts to be in direct reading with it.

All of the shunts gave a drop of at least 30 millivolts when 300 amp. were flowing, this being the maximum current required by any circuit. A millivolmeter was secured which had a full scale drop of 25 millivolts and which was graduated from 0 to 300. Its resistance (practically all copper) was relatively high—about 4 ohms—so that temperature and contact resistance errors would be minimized. Each shunt was then adjusted by means of a simple auxiliary shunt to enable current to be read directly, as follows: If a 2-ft. length of No. 18 wire were connected directly to the ends of the cable which served as a shunt (from *A* to *B* in Fig. 2), practically no change would be made in the reading of the millivoltmeter. If this same piece of wire were connected across the terminals of the instrument, however, practically no reading would be obtained. If connection were made at the proper intermediate points, as shown by the dotted line joining *C* and *D*, the millivoltmeter might be made to read any desired value, provided that without any auxiliary shunt the reading was too high. This condition held for each of the eighteen shunts, so that there remained only the task of locating the proper points at which to connect the auxiliary shunts. This had to be done by trial with the board "live." The length and size of wire used as the auxiliary shunt gives

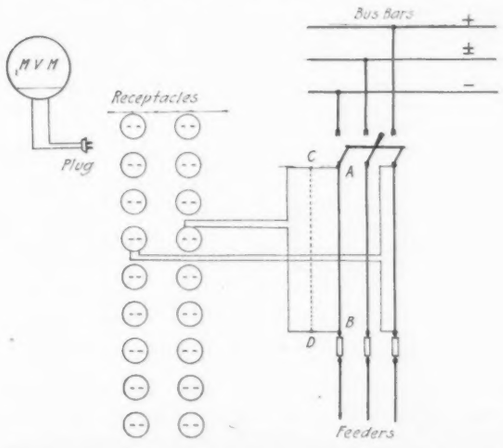


FIG. 2—ARRANGEMENT OF CIRCUITS SHOWING USE OF A SECTION OF CABLE AS AN AMMETER SHUNT

another method of adjustment which proves useful sometimes. After the points were located the joints were soldered and taped and the wire insulated with loom.

In this form the arrangement has been used for over a year and a half and has proved to be all that could be desired. No trouble has been experienced from contact resistance in the plugs, and the accuracy of the adjustment appears to be as good as when first made. The

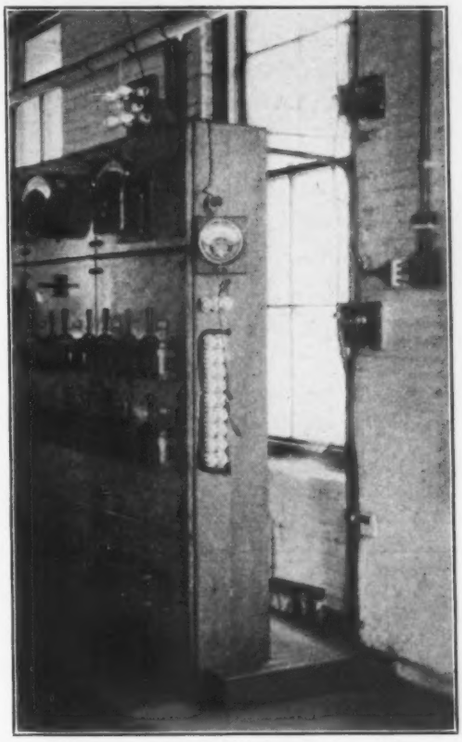


FIG. 1—MILLIVOLTMETER AND PLUG RECEPTACLES CONNECTED TO SECTIONS OF CABLE USED AS SHUNTS

total cost of the installation was about $35, which includes the millivoltmeter but does not include labor. The labor item consisted of about four days' work on the part of the writer, with such additional help as could be utilized—only one man could work at a time to any advantage. As mentioned above, the switchboard was "live" most of the time, the plant having been shut down not more than six hours in the course of the work.

In the illustration several additional receptacles may be seen mounted near the ammeter receptacles. These are for the purpose of allowing a portable voltmeter to be connected to any pair of the three buses for testing purposes. Polarized receptacles were used for this purpose to preclude the possibility of the millivoltmeter plug being accidentally inserted in them. Non-polarized receptacles were used for the current measurement so that in case power was supplied from other sources the plug could be reversed, as there is a generator in the mechanical engineering laboratory and a storage battery in the electrical engineering laboratory which are occacionally used.

Mixture of Graphite and Caustic Soda for Preventing Scale

A mixture of graphite and caustic soda in the proportion of 50 oz. to 30 lb. has been found effective in preventing boiler scale by the chief engineer of a private plant in Brooklyn. His conclusions have been drawn from experience with two 264-hp. Babcock & Wilcox boilers operating at 110-lb. pressure. The boilers are treated alternately, the mixture being fed gradually to one boiler, and during that time it is not blown down. The other unit, however, is blown off to 80 lb. every morning.

Aftermath of Prosperity Week Publicity Seen in Increased Christmas Sales at Brooklyn

The extensive Electrical Prosperity Week advertising conducted by the Brooklyn Edison company, featuring a 10 per cent discount on all electrical appliances sold during the week, not only resulted in record daily appliance sales at the company's electric shop, touching a high point of $1,000 on the last day of the sale period, but the effect of the Prosperity Week impetus has been felt during the succeeding weeks, when the counter purchases of appliances have far exceeded the corresponding demand for last year. During Prosperity Week the electrical contractors and fixture dealers doing business in Brooklyn reduced their prices, as noted in these columns, effecting for the prospective house-wiring customer a 15 per cent discount on all house-wiring contracts closed during the week. This special "Edison house-wiring offer" produced seventy-eight complete house-wiring contracts during the week of Nov. 29 to Dec. 4, and furthermore opened up numerous "leads" of other prospective house-wiring jobs, the contracts for which have since been closed, so that during the second and third weeks of December house-wiring activity in Brooklyn has probably been greater than that for any corresponding period during the year.

Marketing Electricity

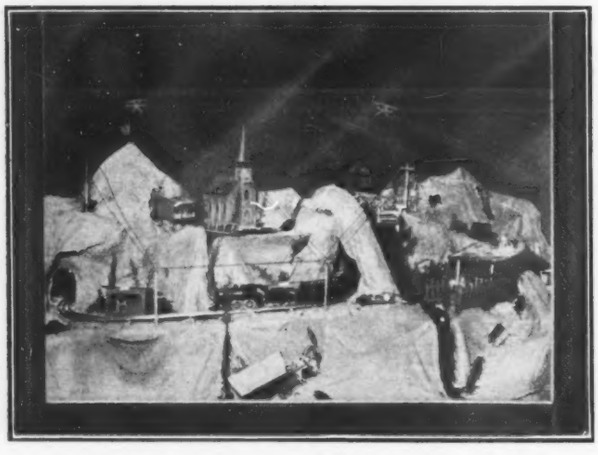
A Department on Selling Service and Widening the Use of Electrical Energy

A Christmas Window That Proved Itself—The Power of Suggestion in Directing Holiday Purchases

The accompanying picture shows a window display which was used last year by the Electric Lighting Supply Company of Los Angeles, Cal., in an effort to sell a considerable stock of electric toys which had been held over from the Christmas previous. The reason these toys were on hand is interesting.

Two years ago this company laid in a large stock of Christmas toys, but made no particular effort to advertise them or display them to the public, devoting the window space to other Christmas-gift suggestions and leaving the toys on the shelves to be sold over the counter. It developed, however, that few voluntary requests for electric toys were received, as the people who came into the store were attracted by the advertising or window displays and called for the specific goods they had in mind.

"Having seen our mistake," says F. H. Trimble, one of the proprietors, "last year we put in the special window shown in the photograph, and the display and its action drew crowds and brought a great number of people into the store. We practically cleaned up the large stock of electric toys held over from the previous year, as well as all the new items added when we decided to feature toys in the window. The window was put in about Dec. 1 and drew trade not only for toys but also for standard appliances throughout the month." This demonstrates in a striking manner the value of the window display as an influence in selling electric toys.



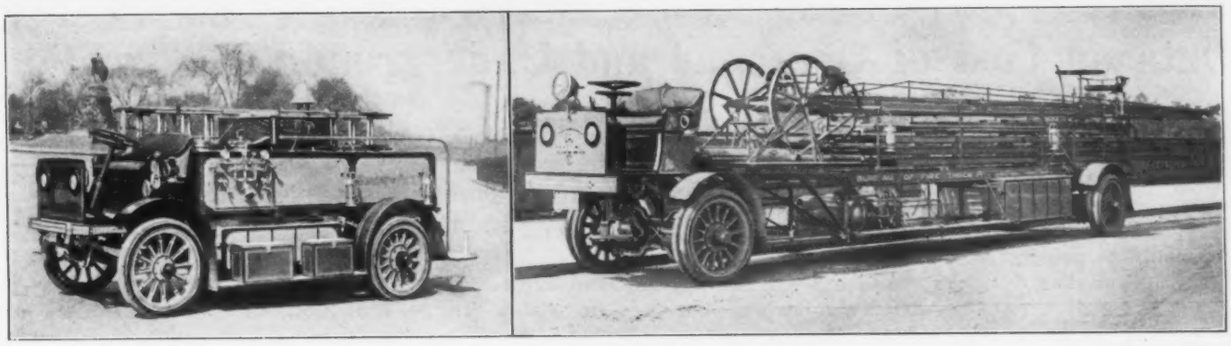
A WINDOW DISPLAY THAT DISPOSED OF A HELD-OVER STOCK OF ELECTRICAL TOYS

Electrically Driven Fire Apparatus in Striking Hill-Climbing Tests at Paterson, N. J.

BY S. G. THOMPSON

A demonstration of electrically driven fire apparatus held last month on the steep grades in and around Paterson, N. J., demonstrated to an audience of fire chiefs and fire commissioners the speed, power and flexibility of this type of apparatus. One of the pieces used was a combination chemical engine and hose wagon which had been converted from horse traction to motor traction by the Commercial Truck Company of Philadelphia. The wagon was fully equipped with twenty lengths of hose and a crew of fourteen men, totaling a weight of 12,300 lb.

A 65-ft. aerial ladder was also demonstrated. This machine, which was also a converted horse-drawn truck, carried a crew of twenty-two men. The ladder with the crew weighed 20,000 lb. The ladder truck was of the four-motor-drive type, one motor being attached to each



ELECTRICALLY OPERATED COMBINATION CHEMICAL FIRE ENGINE AND HOSE WAGON

ELECTRIC AERIAL-LADDER FIRE TRUCK. BOTH MACHINES WERE RECONSTRUCTED FROM HORSE-DRAWN WAGONS

wheel. Both wagons were equipped with "Exide" batteries.

The first part of the test consisted of a run up an 18.23 per cent grade, known as Temple Hill, having an uneven cobblestone paving—a very poor roadway. This test was easily made by both cars, the time from a dead start at the foot of the hill to the summit being for the combination wagon one minute and thirteen seconds and for the ladder truck one minute and nineteen seconds. The former becomes a record for the hill, which has been a test hill for every piece of apparatus used by the Paterson Fire Department, as well as for many others for which manufacturers had aspirations but which failed on the test. The fastest previous time was one minute and forty seconds.

One of the electric pieces under test was then a second time sent up the hill, was stopped dead in the center of the steepest part, and was then run to the top at the same speed as before. This remarkable feat was generously applauded by hundreds of spectators.

The remarkable part of the latter test was the apparent immediate resumption of speed from a dead stop on a grade which has proved too steep for most of the other types of fire apparatus to climb at all and which the touring cars carrying spectators did not even attempt.

The apparatus was next put through a test on the "Temple Street-Clinton Street-Circle Avenue hill." This was also over an 18 per cent grade, and both pieces easily made the trip, the ladder truck making a new record of one minute and fourteen and one-half seconds and the combination truck one minute and twenty seconds. The best previous time made on this hill was considerably more than two minutes.

Further demonstration then followed in various parts of the city, a speed of 30 m.p.h. being maintained on a level stretch on Broadway for about a mile.

Fire Commissioner Shielke of Paterson and Chief Coyle of the Paterson fire department were on the driving seat of the combination wagon. The Pathé company took moving pictures of the demonstration for its weekly pictorial review of events of special interest.

No More "Cut-Price" Sales of Electric Appliances at Warren, Ohio

When it was the practice of the central-station company at Warren, Ohio, to conduct "cut-price" sales on appliances at more or less regular intervals, the argument was often advanced by prospective customers between sales that "Because Mrs. So-and-So got her vacuum cleaner for $— a few months ago, I should be able to get this one for the same price now." An attempt to maintain prices between sales hurt business. Now, however, it has been a long time since a cut-price sale has been conducted, and the old argument is no longer heard. W. J. Marshall, sales manager of the Trumbull Public Service Company, says that his appliance department disposes of more goods under the new scheme, and the local buying public is better satisfied.

Winning the Customer to the Side Street

The recently established fixture and supply house of the C. C. Coghlin Electric Company at 34 Pearl Street, Worcester, Mass., is situated about a hundred yards off Main Street, but the concern did not intend to be overlooked during Electrical Prosperity Week—and it wasn't. To catch the eye of the passers-by on the main thoroughfare of the town, a sign 12 ft. long was equipped with eight 400-watt gas-filled lamps, which were furnished with free energy for daylight as well as night burning by the Worcester Electric Light Company. The lamps were bunched at the outer end of the sign, and they attracted no small amount of attention from a distance, being 12 ft. above the sidewalk and burning in three different positions.

Arriving in front of the company's display window, the visitor found it divided into two sections, one devoted to an exhibit of electric-heating appliances and the other occupied by an artistically arranged layout of polished fixture parts, the word "Electric" being formed in screw-bushings in the center of the bay. Suspension chains separated the two sections of the window as illustrated, and the use of posters and streamers added to the "life" of the display. A final appeal was the attachment of a window card emphasizing the fixture stock of the company to a cord leading to the door, the card rising about 2 ft. behind the glass at every opening.

STORE FRONT OF COGHLIN COMPANY, WORCESTER, MASS.

Data on Cost of Overhead and Underground Construction

Sixth of a Series of Articles on Electrical Contracting Methods, Previous Installments of Which Appeared in the Issues of Oct. 16 and 23, Nov. 20, and Dec. 4 and 11

By Louis W. Moxey, Jr., Vice-President Keller-Pike Company, Philadelphia

THE principal points made in previous installments of the present series of articles, where the subject of the computing of costs and making of estimates for interior construction was dealt with, apply in a general way to overhead and underground work. The present article will, therefore, be devoted chiefly to the discussion of the labor items covering outside work. A note is also appended presenting a practical discussion of voltage drops on overhead alternating-current lines.

Data are given in the accompanying tables relating to cost of underground construction. These figures, however, must not be considered as applicable in all cases, but rather as a guide to the contractor. It must always be borne in mind, of course, that construction costs vary with the type of labor employed and the wages paid. Moreover, local conditions also produce numerous variations in construction cost.

The labor items given in Table XXXVII are those which apply for the case of ordinary transmission work. Where street or road lighting is to be provided items of labor for the erection and connection of lamps, brackets, etc., must be included, together with repairs to pavements, curbs, etc. These labor items will vary considerably, of course, according to the number of poles to be erected and the amount of wire to be strung.

Calculation of Voltage Drop in Overhead Lines

In dealing with overhead-construction problems it must be remembered that the line drop is due to two factors—first, to ohmic resistance, and, second, to the reactance of the line caused by self-induction. The current which will flow under such conditions is expressed by the formula:

$$I = \frac{E}{\sqrt{R^2 + (2\pi fL)^2}}$$

In this formula I is the current in amperes, E the voltage drop, R the resistance of the circuit in ohms, f the frequency in cycles per second, and L the self-induction of the circuit expressed in henries.[1] The factor $2\pi fL$ is known as the reactance of the circuit.

To calculate the total voltage drop resulting from the reactance drop plus the resistance drop, the two must be combined at right angles as shown in the sketch—the hypotenuse of the triangle will then represent the impedance drop; that is, the total drop in voltage along the line.

Data on Underground Construction

The first item to be considered in underground construction is the cost of excavating, which should be figured per cubic yard. Every contractor should know what these costs are under various conditions, such as

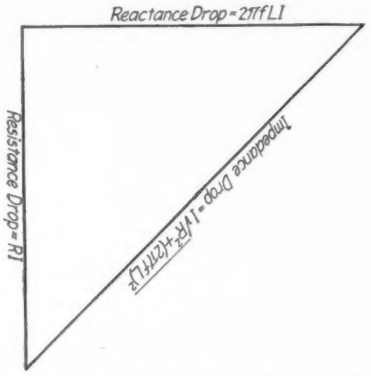


DIAGRAM SHOWING METHOD OF CALCULATING IMPEDANCE, GIVEN THE RESISTANCE AND REACTANCE OF THE CIRCUIT

a sand or clay soil, rotten or solid rock, etc. The average laborer is capable of excavating about 180 cu. ft. of clay soil per ten-hour day.

Manholes must also be taken into consideration. The cost of excavating and concreting such manholes can be estimated from the tables previously given. If the manholes are to be brick-lined, the cost will vary from 40 cents to $1 per cubic foot of brickwork. Such miscellaneous items as the cost of labor for manhole drains, etc., must be figured for each job, since it seems impossible to obtain any fair averages of cost on these items.

Table XLI gives average costs for pulling in and

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[1]The value of L—that is, the self-induction of the circuit—can be accurately and simply determined for the case of a circuit where the outgoing and returning wires are parallel and no iron is near. These conditions exist in most overhead lines.

If l be the total wire length of a two-wire circuit in feet, d the distance between the axes of the two wires, and r the radius of the bare wires expressed in the same units as d, then the self-inductance L of the circuit in henries is expressed by the formula:

$$L = \frac{30.48l\,[0.5 + 4.6052 \log d/r]}{1{,}000{,}000{,}000}$$

For example, take a line 1000 ft. long consisting of two No. 0 copper wires so strung that the distance between the centers of the wires is 12 in. What will be the voltage drop if the value of the alternating current is 10 amp. and its frequency is 125 cycles per second?

The inductance in henries is found by the formula previously given:

$$L = \frac{30.48 \times 2000\,[0.5 + 4.6052 \log 12/0.16]}{1{,}000{,}000{,}000} = 0.00058 \text{ henry.}$$

The resistance of 2000 ft. of No. 0 wire is 0.1996 ohm. The impedance Z then becomes

$$Z = \sqrt{R^2 + (2\pi fL)^2} = \sqrt{0.1996^2 + (2 \times 3.1416 \times 125 \times 0.00058)^2} = 0.47 \text{ ohm.}$$

The voltage drop is $E = IZ = 10 \times 0.47$, or 4.7 volts. The voltage drop due to resistance, on the other hand, is only 10×0.1996, or 1.996 volts.

Suppose that the allowable drop in volts is specified in the case of a three-phase, three-wire transmission line with the wires placed at the corners of an equilateral triangle and that the size of the wires must be determined. Let 300 kw. be the energy to be transmitted, the frequency being sixty cycles per second, the pressure 1200 volts, and the voltage drop 5 per cent, the wires being 24 in. apart between centers, and the length of the line (single-wire distance) 1800 ft.

$$\text{Current per phase} = \frac{300{,}000}{1200\sqrt{3}} = 145 \text{ amp.}$$

If the line were a single-phase circuit, the current would be 250 amp. To calculate the loss in the case of a three-phase feeder, consider each conductor as carrying 125 amp. (that is, one-half of the corresponding single-phase current) and complete the calculations as in the case of a single-phase line.

$$\text{Volts drop} = 0.05 \times 1200 = 60 \text{ volts.}$$

$$\text{Double distance} = 3600 \text{ ft.}$$

$$L = \frac{30.48l\,(0.5 + 4.6053 \log d/r)}{1{,}000{,}000{,}000}$$

At this point it is necessary to assume a value for r; that is, the radius of the conductor. Let 0.3 in. be assumed, this being the approximate radius of a 300,000-circ.-mil cable. The log d/r does not change appreciably with slight changes in r owing to the relatively great value of d, and hence great accuracy is unnecessary.

$$L = \frac{30.48 \times 3600\,(0.5 + 4.6052 \log 24/0.3)}{1{,}000{,}000{,}000} = 0.001$$

$$\text{Impedance} = \sqrt{R^2 + (2\pi fL)^2} = \sqrt{0.126^2 + (2 \times 3.1416 \times 60 \times 0.001)^2} = 39 \text{ ohms.}$$

Now 0.126 ohm is the ohmic resistance of 3600 ft. of 300,000-circ.-mil cable.

$$I \times \sqrt{R^2 + (2\pi fL)^2} = E,$$

$$\text{or } 125 \text{ amp.} \times 0.39 = 48 \text{ volts.}$$

As 60 volts drop is permissible and a 300,000-circ.-mil cable gives only 48 volts drop, a No. 0000 wire will be found to be approximately correct for a drop of 60 volts.

splicing cables. Only average figures for labor cost are given, and the range of variation in many cases will be found to be greater than that presented in the table.

The seventh and concluding article of the present series will take up the subjects of illumination and illumination calculations.

TABLE XXXVII—COST OF POLE-LINE CONSTRUCTION

Labor Item	Description	Cost
Shaving poles	25-ft. pole	$0.60— $1.20
	30-ft. pole	0.80— 1.60
	35-ft. pole	1.00— 2.00
	40-ft. pole	1.20— 2.40
	50-ft. pole	1.40— 2.80
Erecting wood poles	25-ft. pole	0.90— 2.70
	30-ft. pole	1.20— 3.60
	35-ft. pole	1.80— 5.40
	40-ft. pole	2.70— 8.10
	50-ft. pole	3.90— 11.70
Erecting iron poles	25-ft. pole	2.00— 8.00
	30-ft. pole	3.00— 12.00
	35-ft. pole	5.00— 20.00
	40-ft. pole	8.00— 32.00
	50-ft. pole	12.00— 48.00
Digging holes	25-ft. pole	0.60— 3.00
	30-ft. pole	0.75— 3.75
	35-ft. pole	0.90— 4.50
	40-ft. pole	1.05— 5.25
	50-ft. pole	1.20— 6.00
Stepping poles	25-ft. pole	0.50— 1.00
	30-ft. pole	0.75— 1.50
	35-ft. pole	1.00— 2.00
	40-ft. pole	1.25— 2.50
	50-ft. pole	1.50— 3.00
Guying poles	25-ft. pole	3.00— 9.00
	30-ft. pole	4.00— 12.00
	35-ft. pole	5.00— 15.00
	40-ft. pole	6.00— 18.00
	50-ft. pole	7.00— 21.00
Erecting cross-arms, braces, pins and insulators	2-pin cross-arm	$0.50— $1.00
	3-pin cross-arm	0.60— 1.20
	4-pin cross-arm	0.70— 1.40
	6-pin cross-arm	0.90— 1.80
	8-pin cross-arm	1.10— 2.20
Stringing wire, triple-braid, weatherproof, per 1000 ft.	No. 8	$2.50— $5.00
	No. 6	2.60— 5.20
	No. 5	2.80— 5.60
	No. 4	3.10— 6.20
	No. 3	3.50— 7.00
	No. 2	4.00— 8.00
	No. 1	4.60— 9.20
	No. 0	5.20— 10.40
	No. 00	6.00— 12.00
	No. 000	6.90— 13.80
	No. 0000	7.90— 15.80

TABLE XXXVIII—OUTSIDE DIMENSIONS OF VITRIFIED DUCTS

Type	Bore, Round or Square	Outside Dimensions, Inches
Single-way	3½-in.	5 x 5 x 18
Two-way	3½-in.	4 x 9 x 24
Three-way	3½-in.	5 x 13 x 24
Four-way	3½-in.	9 x 9 x 24
Six-way	3½-in.	9 x 13 x 36
Nine-way	3½-in.	13 x 13 x 36
Nine-way	2 -in.	9 x 9 x 36

TABLE XXXIX—LABOR COSTS PER FOOT FOR LAYING DUCTS

Item	Cost
Laying duct and cementing joint:	
Single-way	$0.03—$0.06
Two-way	0.05— 0.10
Three-way	0.08— 0.16
Four-way	0.10— 0.20
Six-way	0.14— 0.28
Nine-way	0.20— 0.40
Laying conduit or pipe:	
½-in. conduit	$0.03 —$0.05
¾-in. conduit	0.04 — 0.06
1 -in. conduit	0.05 — 0.07
1¼-in. conduit	0.06 — 0.08
1½-in. conduit	0.065— 0.09
2 -in. conduit	0.07 — 0.10
2½-in. conduit	0.075— 0.11
2½-in. conduit	0.08 — 0.12
3 -in. conduit	0.09 — 0.14
4 -in. conduit	0.12 — 0.18

TABLE XL—AMOUNTS OF CEMENT, SAND AND STONE REQUIRED PER CUBIC YARD OF RAMMED CONCRETE

Stone, Mixtures 1 In. and Under			Screened-Out Amounts		
Concrete	Sand	Stone	Concrete, Bbls.	Sand, Cu. Yd.	Stone, Cu. Yd.
1	2	4	1.46	0.44	0.89
1	2.5	5	1.19	0.46	0.91
1	3	5	1.11	0.51	0.85
1	3	6	1.01	0.46	0.92
1	3	7	0.91	0.42	0.97
1	4	7	0.83	0.51	0.99
1	4	8	0.77	0.47	0.93

TABLE XLI—LABOR COSTS FOR PULLING IN AND SPLICING CABLES

Size, B. & S. or Circ. Mil	Pulling Cable, Cost per Ft.	Splicing Cables, Cost per Splice
Single-conduit:		
No. 14	$0.02	$1.10
12	0.025	1.20
10	0.03	1.30
8	0.035	1.40
6	0.04	1.55
5	0.045	1.70
4	0.05	1.85
3	0.055	2.00
2	0.06	2.20
1	0.0625	2.40
0	0.065	2.60
00	0.0675	2.80
000	0.07	3.05
0000	0.0725	3.30
250,000	0.075	3.55
300,000	0.0775	3.80
350,000	0.08	4.10
400,000	0.085	4.40
450,000	0.09	4.70
500,000	0.095	5.00
550,000	0.10	5.30
600,000	0.105	5.60
650,000	0.11	5.90
700,000	0.115	6.20
750,000	0.12	6.50
800,000	0.125	6.80
850,000	0.13	7.10
900,000	0.14	7.40
950,000	0.15	7.70
1,000,000	0.16	8.00
Duplex:		
No. 14	$0.03	$1.56
12	0.04	1.80
10	0.045	1.95
8	0.05	2.10
6	0.06	2.30
5	0.07	2.55
4	0.08	2.80
3	0.09	3.00
2	0.09	3.30
1	0.095	3.60
0	0.10	3.90
00	0.105	4.20
000	0.11	4.65
0000	0.115	5.00
250,000	0.12	5.40
300,000	0.125	5.80
350,000	0.13	6.20
400,000	0.135	6.60
450,000	0.14	7.10
500,000	0.15	8.00
Triplex:		
No. 14	$0.04	$2.20
12	0.045	2.40
10	0.05	2.60
8	0.055	2.80
6	0.065	3.10
5	0.075	3.40
4	0.09	3.70
3	0.10	4.00
2	0.11	4.40
1	0.12	4.80
0	0.13	5.20
00	0.14	5.60
000	0.15	6.10
0000	0.16	6.60

The figures given for pulling cable do not include rodding or fishing of ducts, which varies from $0.005 to $0.03 per duct foot.

Gas-Heated Boiler Helps Secure Motor Service in Plating Plant at Dayton, Ohio

BY F. B. STEELE

By recommending the use of an automatic gas-fired pressure-controlled boiler of the type illustrated herewith the Dayton (Ohio) Power & Light Company was able to place a motor-service installation in a plating plant where the use of industrial steam had previously kept the new-business department from securing a contract. The 6-hp. cast-iron boiler shown, which is made by a Pittsburgh firm, is supplied with soft water by the feed pump at the right, which is driven by a ⅛-hp. motor controlled by a float switch. Steam in this case is supplied at 10-lb. pressure and is used for heating water in four 4-ft. by 4-ft. by 4-ft. tanks in the plating room. The steam is piped through a main header to coils in each tank and closed through another header to the boiler.

BOILER AND MOTOR-DRIVEN FEED PUMP

The only attention needed at the boiler is at the time of starting and stopping its operation at the beginning and end of each working period. No special attendant need be employed to keep it running. With gas at 30 cents per 1000 cu. ft. the cost of operating this boiler for nine hours a day has not exceeded $15 a month.

Demonstrating a Child's Electric Range During Electrical Prosperity Week

In connection with its apparatus displays during Electrical Prosperity Week, the Worcester (Mass.) Electric Light Company had an attractive demonstration of the Western Electric Company's "junior" electric range, a winsome and enthusiastic operator being found in the person of Miss Dores Underhill, the nine-year-old daughter of O. R. Underhill of the central-station company's appliance department. As a result of the first afternoon's demonstration, two of these ranges, rated at 460 watts and equipped with an oven and six hot-plates, were sold. Recently little Miss Underhill prepared the following dinner for five playmates, using this range in one forenoon only: Roast of beef, 0.5 lb.; boiled and baked potatoes, macaroni, apple sauce, stewed tomatoes, biscuits, loaf of bread, two 3.25-in.-diameter apple pies, baked custards and two kinds of cake. The cost of energy was under 12 cents, the lighting rate at Worcester being 9 cents per kilowatt-hour. A number of these ranges have been sold by the company at $8 each within the last six weeks, and an additional order has been placed with the manufacturer to meet the anticipated holiday demands.

DEMONSTRATING THE MINIATURE RANGE

LECTURE CLASS IN ELECTRICAL APPLIANCES

New York Edison Company Inaugurates Lecture Course in Electric Appliances

The New York Edison Company, under the direction of Arthur Williams, general commercial manager, has inaugurated a new course of twelve lectures in the curriculum of its commercial school on electric appliances.

On Dec. 9 J. F. Kelly, manager of the company's showrooms, spoke on the subject of "The Importance of Electrical Appliances to the Central Station," and F. C. Henderschott, manager of the company's educational bureau, followed with an address on "Salesmanship."

Other lecture topics for the winter and spring months are as follows: Dec. 23, "The Showrooms"; Jan. 6, "Domestic Heating by Electricity"; Jan. 20, "The Heating Bureau"; Feb. 3, "Vibrators and Small Motors"; Feb. 17, "Heating Appliances and Vacuum Cleaners"; March 2, "Heating Appliances and Vacuum Cleaners"; March 16, "Washing Machines and Dish-Washers"; April 13, "Electric Signs"; April 27 and May 11, "Home Economics."

Technical Advance in Theory and Practice

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FLUID ANALOGIES FOR MAGNETISM

An Interesting Application of Van der Waals' Equation of the Continuity of the Gaseous and Liquid State to the Continuity of the Paramagnetic and Ferromagnetic Conditions

Physical analogies, like mechanical models, are often useful and have been and are universally employed to create in the student's mind a familiarity with unfamiliar subjects. The term "electric current" is based on the analogy between electricity and hydraulics, and no less a theorist than Clerk Maxwell, in reducing Faraday's fundamental experimental results to fundamental mathematical theory, based the whole discussion on the mechanical model of the flow of an incompressible liquid in tubes (corresponding to the electromagnetic lines of force). In the *Philosophical Magazine* of November, 1915, Dr. J. R. Ashworth uses in an interesting and suggestive way a physical analogy to comprise the paramagnetic and ferromagnetic conditions in one equation. His equation follows closely Van der Waals' "equation of state," which is, after all, nothing more than a modification of the well-known Boyle-Mariotte-Gay Lussac law for gases so as to comprise liquids as well as gases.

P. Curie found in 1895 that feebly magnetic substances have in general an intensity of magnetization I (magnetic moment per unit volume) in simple inverse ratio to the absolute temperature T in a constant field of force. Further the intensity of magnetization I of feebly magnetic or paramagnetic substances is directly proportional to the strength of the field H. Hence the behavior of paramagnetic substances in relation to field strength and temperature is completely described by the relation $H/I = R'T$. This is obviously analogous to the Boyle-Mariotte-Gay Lussac law $Pv = RT$ or $P/d = RT$ for gases, where P is the pressure, v the specific volume and $d = 1/v$ the density. It will be seen that in this analogy the intensity of magnetization I corresponds to the density d and the field strength H to the pressure P.

Now, Curie's researches led him further to the conclusion that ferromagnetic substances when heated are transformed *progressively* and tend to assume the properties of feebly magnetic substances as the temperature passes and increases beyond the point of transformation, and that there is a close analogy between curves of magnetization of a ferromagnetic as it changes to the paramagnetic state in a constant field and curves of density of a liquid as it passes to the gaseous state at constant pressure when the temperature is raised. Moreover, this parallelism seems to be based on the same underlying physical cause. From the point of view of molecular theories the passage of a fluid from the liquid to the gaseous state takes place when the molecules of the fluid are released from reaction one on the other and become independent, and in like manner we may imagine that the passage from the ferromagnetic to the paramagnetic state takes place when the molecular magnets pass from reaction one upon the other to freedom from mutual control. Further molecular theories of fluids show that there must be a limit to the density under the action of high pressures and low temperatures, and correspondingly molecular theories of magnetism show that there must be a limit to the intensity of magnetization under the influence of strong fields and low temperatures. Thus we may regard the ferromagnetic and paramagnetic states in magnetism as analogous to the liquid and gaseous states in fluids.

Van der Waals modified the gas law so that it would include the behavior of liquids. His equation is

$$(P + ad^2)(1/d - 1/d_o) = RT$$

In an analogous way, Ashworth modifies Curie's relation so as to cover both the paramagnetic and ferromagnetic states:

$$(H + a'I^2)(1/I - 1/I_o) = R'T$$

The constants a', I_o, R' are the fundamental magnetic constants. Ashworth applies this equation to iron, nickel and cobalt. For R' and for the maximum intensity of magnetization I_o experimental data are available. The value of a' may be estimated from the values of the other constants. Several applications of the formula are made. It is shown that the equation represents broadly the chief features accompanying the loss of ferromagnetism with increase of temperature, namely, at first a region of progressive and increasingly rapid loss up to the temperature of transformation, secondly an abrupt transition through a region of instability, and thirdly a region in which the magnetic intensity declines less and less quickly and approaches the temperature axle symptotically. From a knowledge of the value of a' it is possible to calculate the magnitude of the intrinsic field for any intensity of magnetization. This leads for iron, nickel and cobalt to a value of the intrinsic field of the order of 10^7 gausses. Finally it is shown that the application of Van der Waals' equation to magnetism leads to results which are at least not in conflict with the kinetic theories of Langevin and Weiss. The table gives the fundamental magnetic constants of iron, nickel and cobalt according to this theory.

MAGNETIC CONSTANTS OF IRON, NICKEL AND COBALT

	Iron	Nickel	Cobalt
Constant, R'	3.56	20 8	6.0
Maximum intensity, I_o	1685	510	1300
Intrinsic field constant, a'	7.6	96	21
Critical temperature, T_c	785°+273°	388°+273°	1075°+273°
Maximum intrinsic field, $a' I_o^2$	2.2×10^7	2.4×10^7	3.6×10^7

Generators, Motors and Transformers

Design of High-Speed Generators.—A. B. FIELD.—An illustrated paper read before the (British) Institution of Electrical Engineers on some difficulties of the design of high-speed generators. A 20,000-kw., 1800-r.p.m., four-pole, sixty-cycle, 13,200-volt, three-phase generator is made the basis of discussion. The author discusses the rotor material and is in favor of Behrend's construction, using thick open-hearth rolled plates consolidated and mounted on a shaft. After the discussion of plate-built rotors, the author deals with critical speed and rotor ventilation. For the latter he recommends a

combination of an axial passage underneath the winding slots with a radial discharge distributed over a fairly wide central portion of the rotor. He then deals with rotor windings, coil-retaining rings, rotor-coil bracing, stator construction, external short-circuits, stator-coil bracing and rotor surface losses. He finally mentions the difficulty which the designer encounters in connection with the size of the conductor he has to use. "Increasing the copper section to relieve the temperature conditions tends to introduce troubles as fast as we cure them. For instance, were it possible to use, say, a fused silica tube for stator insulation, we could immediately cut down the size of the slot copper, at the same time overcoming much of our eddy-current trouble, and we should have no reason to be alarmed even should the central part of the active length of the conductor occasionally reach very high temperatures. Some of the characteristics of fused silica and the recent rapid commercial development of this material are promising as far as they go, but many obstacles to its use for this purpose still remain."—London *Electrician*, Nov. 26, 1915.

Lamps and Lighting

Mercury Arc.—J. C. MCLENNAN AND R. C. DEARLE.—An account of an experimental investigation of the infra-red emission spectrum of the mercury arc. Thirteen lines are recorded in the infra-red spectrum of the mercury arc between the wave-lengths 1.00 μ and 3.02 μ. The existence of the line near 1.04 μ, which was shown to exist by Coblentz and Geer, but which was not found by later investigators, was confirmed by the finding of a line at 1.038 μ. The existence of at least one line with a wave-length longer than 1.70 μ was proved by the discovery of a line at 3.02 μ, which was also in confirmation of the work by Coblentz and Geer. Three new lines were discovered in the infra-red spectrum.—*Philos. Magazine*, November, 1915.

Generation, Transmission and Distribution

Distortion of Voltage Curves in Large High-Tension Networks.—J. BIERMANNS.—A mathematical article illustrated by diagrams. When an alternating-current voltage is impressed on the transmitting end of a transmission line, considerable rises of voltage may occur at the receiving end due to the effect of distributed self-induction and capacity whenever the frequency is high. This phenomenon is unimportant, however, with ordinary commercial frequencies in distribution networks. But the higher harmonics in a voltage curve which is not strictly sinusoidal may be strongly influenced by this effect. This explains why even transmission lines fed from turbo-generators may have considerably distorted voltage curves at points at a distance from the power plant. Inductive loads connected to the line counteract this effect, while the effect is made worse by capacity loads. Transformers connected between generator and line also favor the distortion of the voltage curve. These resonance phenomena may be completely suppressed by oscillation circuits tuned to the harmonics in question.—*Elek. Zeit.*, Nov. 18, 1915.

Economics of Electric Power-Station Design.—H. F. PARSHALL.—His illustrated paper read before the International Engineering Congress in San Francisco somewhat abstracted. While there may not be any great choice as to the type of plant to be used in a power house, there are many questions as to the economies to be gained by increasing the size of plant and by centralization. The present paper deals with the constants involved in this general problem, and, as illustrative of the nature of the problem, particulars are given of the electric supply of London.—London *Electrician*, Nov. 26, 1915.

Installations, Systems and Appliances

Russia.—Statistical data on Russian electricity works. The table covers eighty stations, of which fifty-four give direct current, twenty-two alternating current, and four supply both. Forty-seven have steam power, sixteen gas, sixteen steam and gas, and one water power. Fifty-nine of the stations are specifically designed for lighting and power, ten for tramways, and eleven for lighting, power and tramways. The largest rating (35,000 kw.) is that of the Moscow lighting station, which supplied 53,000,000 kw.-hr. in 1913. The next largest station is the Whitetown station of Baku (29,000 kw.), which supplied 73,000,000 kw.-hr. in 1913.—London *Elec. Review*, Nov. 26, 1915.

Controllers.—H. MOELLER AND TH. HOOCK.—An article illustrated by diagrams on the rating and the selection of controllers for intermittent operation of cranes, tools, etc. The authors first discuss the different elements which determine the choice of a controller and then the elements which determine the design and step arrangement of the controller resistors, namely, the capacity needed during the starting period, the nominal rating of the motor, the duration of the starting period, and the number of starting operations per hour.—*Elek. u. Masch.* (Vienna), July 18 and 25, 1915.

Starting Rotary Converters.—W. LINKE.—An English translation in abstract of two recent German articles on the starting of rotary converters considered from a practical standpoint.—London *Electrician*, Nov. 19, 1915.

Wires, Wiring and Conduits

Electrolytic Copper.—B. WELBOURN.—The chairman's address to the Manchester Section of the British Institution of Electrical Engineers. After some short notes on electrolytic copper refining, the author points out that for the transmission of electricity two varieties only are required: first, hard-drawn copper, which comprises all conductors in which mechanical strength is required, and, second, soft or annealed copper, which comprises all conductors which are to be continuously insulated and in which the highest obtainable conductivity is required. The British standard for copper conductors is the one issued by the British engineering standards committee in 1910, but this needs revision in view of the fact that an international standard of resistance for copper has been formulated by the International Electrotechnical Commission and has already been adopted in the new standardization rules of the American Institute of Electrical Engineers. The testing of annealed copper conductors is very simple and is confined to gaging the wires with a micrometer gage and measuring the ohmic resistance, and sometimes to the weighing of samples or coils. In the case of hard-drawn copper additional tests are necessary to determine tensile strength, hardness, elastic limits and absence of brittleness. These tests are discussed at some length with special reference to the effect of temperature on elasticity and tensile strength.—London *Elec. Review*, Nov. 19 and 26, 1915.

Dielectric Losses.—An English translation in abstract of a recent German article giving results of the determinations by the German Telegraph Department of the dielectric losses in various insulators.—London *Electrician*, Nov. 19, 1915.

Electrophysics and Magnetism

Magnetic Studies of Mechanical Deformation in Ferromagnetic Metals and Alloys.—H. HANEMANN AND PAUL D. MERICA.—Simultaneous magnetic and mechanical measurements were made in the tensile-testing machine on soft iron and other materials, with a view to determining whether relations existed between the

physical and the magnetic constants of such materials. It was found that the permeability of iron is independent of the previous elastic history of the materials if (1) the alternations or cycles of stress have been within the elastic limit and (2) the number of alternations has been small. There is a close and nearly linear relation between the elastic limit of soft iron and the values of the stress at which the permeability maxima occur as the material is elongated. The magnetic indications and accompanying features of mechanical overstrain were studied. The conclusion is reached that the magnetic method is applicable to the study of the previous mechanical history of such annealed iron as was investigated, since indications are thus given of the values of the maximum stress to which it has been subjected, provided that this stress has been above the elastic limit. The permeability of this material is not affected by stress applications under the elastic limit. The effect of initial stresses upon the form of the induction-stress curves was noticed in the case of material as received, before annealing, and as heat-treated by quenching in water.—*Bulletin Amer. Inst. Mining Engrs.*, December, 1915.

Electrochemistry and Batteries

Electrolytic Copper Refining.—FRANCIS R. PYNE.—Two evils in electrolytic-copper-refining practice are the tendency of the electrolyte to stratify or form layers of various compositions and the accumulation of impurities in the electrolyte. To prevent stratification the electrolyte is circulated throughout the tanks. To prevent

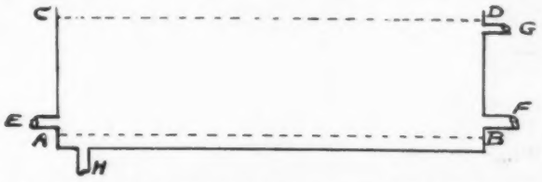


FIG. 1—TANK DESIGNED TO FACILITATE THE ELECTROLYTIC REFINING OF COPPER

fouling of the electrolyte by impurities a certain amount of electrolyte is daily withdrawn and passed through tanks containing insoluble anodes. The treatment in these removes a large part of the copper from the electrolyte but requires large power expenditure. The solution from this first set of insoluble-anode tanks is then passed through a second set, and this second set of tanks removes the rest of the copper and practically all of the arsenic and antimony. The solution is then treated in any suitable manner for the elimination of such other impurities as may be desired. The author's new process saves the considerable amount of power required for the first set of insoluble solution tanks by withdrawing from the regular tanks a solution sufficiently low in copper to avoid this first-set treatment, yet containing practically an undiminished amount of impurities. The fact of the formation of stratifications is made use of. The diagram above shows a tank designed for this purpose (the electrode not being shown for the sake of clearness). *AB* is the slime line, *H* the outlet for removal of slime from the tank, *CD* the solution line. The electrolyte enters the tank at *E* and is withdrawn through the upper and lower outlets *G* and *F* respectively. Just sufficient circulation of the electrolyte is maintained to get a satisfactory cathodic copper deposit, but not enough circulation to prevent stratification. The electrolyte withdrawn from the upper outlet *G* is a low-grade solution which is delivered directly to the second set (in former practice) of insoluble-anode tanks for treatment. Compared with former practice, the net saving in this process, which is in use at the United States Metals Refining Company's plant at Chrome, N. J., is, therefore, the operation of one set of insoluble-anode tanks.—*Met. and Chem. Eng'ing*, Dec. 1, 1915.

Units, Measurements and Instruments

Simple Thermal Instruments for the Measurement of Small High-Frequency Currents.—W. H. ECCLES AND A. J. MAKOWER.—If an air-bubble is formed in a horizontal glass tube containing alcohol, the application of a source of heat to the outside of the glass near one end of the bubble will cause the bubble to move toward the point of higher temperature. The source of heat may be a thermo-junction or a resistance wire. When the glass tube is straight and horizontal the instrument is very sensitive but has no definite zero. To get a practical instrument a slight upward convexity is given to the glass tube. For instance, a tube of 0.38 cm. (5/32 in.) bore and 0.038 cm. (5/320 in.) thickness of wall, bent to form an angle of about 10 deg. at the center, gives a very stable zero with a bubble of air of about 0.5 cm. (3/16 in.) length in alcohol. If thermo-junctions are used, the hot junction is placed at one end of the bubble and the cold junction at the other end. In the instrument shown in longitudinal section and cross-section in Fig. 2 the heat was generated in a single bare resistance wire *A* (No. 47 S. W. G. "Eureka") laid across the top of the tube close to one end of the bubble. The fine wire used was of only a few millimeters length, so as to touch the tube only on a short arc and thus keep the resistance of the instrument as low as possible. The value of the resistance was 0.75 ohm. The short "Eureka" heater was connected at both ends to copper leads, and when the current passed the motion produced in the bubble was measured by the eyepiece scale of a microscope focused on an edge of the bubble. The calibration obtained is shown in Fig. 3. The motion of the bubble appears to be due to change of surface tension being caused by change of temperature. This

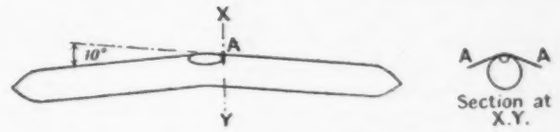


FIG. 2—LONGITUDINAL AND CROSS-SECTIONS OF CURRENT-MEASURING APPARATUS

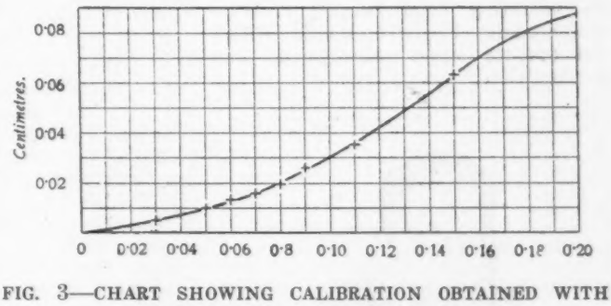


FIG. 3—CHART SHOWING CALIBRATION OBTAINED WITH CURRENT-MEASURING INSTRUMENT

was borne out by a further experiment made with a vertical capillary tube with its lower end dipping into a reservoir of alcohol and provided with a heater forming a semicircular arc round the capillary tube at the top of the meniscus. The calibration curve of this instrument is also given in the article. Special advantages of this type of instrument are freedom from electric capacity troubles and small self-induction.—London *Electrician*, Nov. 19, 1915.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Francis T. Homer of Bertron, Griscom & Company has been elected vice-president of the United Gas & Electric Corporation.

Otto E. Osthoff, vice-president of H. M. Byllesby & Company, Chicago, has been elected president of the Caribbean & Southern Steamship Company.

C. L. Hall, formerly of the Savannah (Ga.) Electric Company, has been appointed superintendent of lighting of the Tampa (Fla.) Electric Company.

V. S. Hillyer of Ishpeming, Mich., has resigned as superintendent of county road construction to become construction engineer with the Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.

E. G. Connett, president of the International Railways Company of Buffalo, N. Y., has been elected vice-president of the United Gas & Electric Corporation and president of the United Gas & Electric Engineering Corporation of New York City.

Richard J. Parisian, superintendent of the unique English school of the Ford Motor Car Company, Detroit, Mich., which graduated more than 100 employees in the spring class, was for four years superintendent for the Edison Illuminating Company of Detroit. Two years ago Mr. Parisian entered the employment of the Ford company as an electrical engineer.

Edward M. Graham, son of the late John R. Graham, president of the Bangor (Me.) Railway & Electric Company, has been elected vice-president and general manager of the Bangor company, the Bangor Power Company and the Orono Water Company and general manager of the Bar Harbor & Union River Power Company, succeeding his father in the active management of these properties. Mr. Graham is only twenty-six years of age and is one of the youngest general managers in the country in charge of such an extensive property. He has been in active charge of the companies since the death of the elder Mr. Graham last August. The companies of which Mr. Graham is now the operating head furnish central-station energy to sixteen municipalities and operate street railways in nine communities.

E. M. GRAHAM

Prof. Clarence E. Reid, formerly of the Mississippi Agricultural and Mechanical College, has been appointed professor of electrical engineering at the Kansas State Agricultural College, Manhattan, Kan.

Philip A. Weiler of the Keystone Electric Company, Reading, Pa., has been appointed chief of the Reading electrical bureau. He will have charge of the fire-alarm, police-telegraph and city telephone systems in Reading.

L. Clark has been appointed local manager of the North Coast Power Company, successor to the Washington-Oregon Corporation, Vancouver, Wash. Mr. Clark succeeds H. K. Lugger, who was recently appointed master of maintenance of the company.

William H. Tylee of Worcester, Mass., has been elected president of the Public Electric Light Company of Boston, Mass., to succeed D. V. Carruth of Clinton, who was one of the incorporators and acted as temporary president until a permanent organization could be effected.

A. J. Klatte has been appointed acting electrical engineer of distribution for the Chicago Surface Lines to succeed Herbert M. Wheeler, deceased. Since the consolidation of the Chicago City Railway and the Chicago Railways Mr. Klatte has served as assistant engineer of electrical distribution.

Patrick J. O'Donnell has been appointed manager of the Mount Forest (Ont.) municipal lighting plant. Mr. O'Donnell was formerly superintendent of electric lighting for the city of West Toronto, and after the local system was taken over by the Toronto hydroelectric system, he served for four years as power and lighting salesman.

A. P. M. Fleming, superintendent of the British Westinghouse works at Manchester, England, is at the University of Illinois, Urbana, in consultation with Prof. E. B. Paine, head of the electrical engineering department, having been sent to the United States by the British government to make an investigation of American institutions organized to conduct industrial research. England, it is explained, realizes the need of perfecting the British agencies of engineering research in order to meet successfully the new commercial competition that is certain to arise after the close of the war.

William T. Taylor, a well-known British electrical engineer, has been promoted to the rank of company commander of the Twelfth Lancer Regiment, Pioneers. Mr. Taylor, who is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers and of the corresponding institutions of Great Britain, is the author of "Transformer Practice." At the outbreak of the war Captain Taylor was in Bolivia and at once journeyed home to join his colors. He had previously served in the Bechuanaland campaign (1897) and in the South African war (1899-1902).

Obituary

W. T. Jackson, for many years a representative of G. M. Gest, engineer and contractor, with headquarters at Cincinnati, Ohio, is dead, following a nervous breakdown resulting in a complication of diseases. Mr. Jackson's death occurred at Atlantic City, N. J., and his body was taken to Cincinnati for burial.

Willard Cheney Knight, son of Charles S. Knight, the former general manager of the original Fort Wayne (Ind.) Electric Corporation, died recently in London, England. During his career in the United States Mr. Knight became well known as manager of the St. Louis office of the Fort Wayne Electric Works.

William Andrew Conner of Plainfield, N. J., vice-president of the Standard Underground Cable Company, died suddenly Dec. 6, in his office at Perth Amboy, N. J. Mr. Conner was born in Baltimore, Sept. 12, 1859. In 1885 he took charge of the first plant built by the Standard Underground Cable Company in Pittsburgh, Pa., and from then until the time of his death he was the head of the manufacturing business of that company, including large plants planned and built by him in Pittsburgh, Perth Amboy, N. J., Oakland, Cal., and Hamilton, Canada. He was a director of the company for ten years and had been first vice-president since 1909. He was also vice-president of the Perth Amboy Trust Company, in whose organization he had an active part. Mr. Conner was a Scottish Rite Mason and a Knight Templar, a member of the Duquesne Club, Pittsburgh; the Hamilton Club, Hamilton, Canada, and the Plainfield Country Club. Mr. Conner was a cousin of E. J. Waring of the Standard Underground Cable Company and of the late Richard S. Waring, its founder.

W. A. CONNER

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Tools for High-Tension-Line Maintenance

A number of special devices and tools are shown in the accompanying illustrations which are designed to offer an easy solution of the usually difficult and dangerous operations met with in high-potential live-line maintenance. These tools are especially well adapted for use in re-insulating lines with

FIG. 1—PLAN VIEW OF STRAIN CLAMP

pressures up to 110,000 volts without interrupting service. They include, besides the Johnson transmission-line clamps, as they are called, the Johnson insulator changer, which is a device for lifting heavy conductors; various spe-

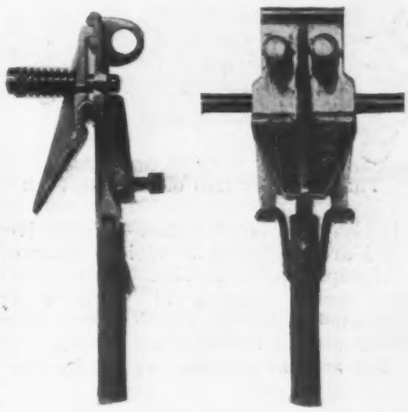
FIG. 2—SIDE VIEW OF STRAIN CLAMP

cial sticks to which are attached tongs, hack-saws, cotter-key pullers, etc.; a Y-stick for lifting light conductors and holding suspension-type insulators; safety-clamp sticks, and the like.

Practically all operations in connection with making live connections without interrupting service are based on the use of the transmission-line clamps. Transformers and meters can also be connected to their respective buses by means of these clamps in such a way that any one of the meters or transformers may be removed, repaired and replaced without service interruptions. The clamps are also convenient for use in grounding transmission lines prior to working upon them, especially when the induced charge on the dead line is dangerous; in joining two live lines, or for making branch-line taps to the main transmission lines without shutting off the power or in any way interfering with service over the line; in sectionalizing telephone and transmission lines, or for use in place of the simple disconnecting switch in cutting in electrolytic lightning arresters, static-discharge gaps, etc., or with live lines in transferring the load from one line to another on the same pole or tower in order to jump around trouble, and in connecting transformers of a bank to their respective buses, which, in case of delta connection, permits the removal of any one of the transformers for repairs, allowing the bank to run in open delta until the transformer is replaced.

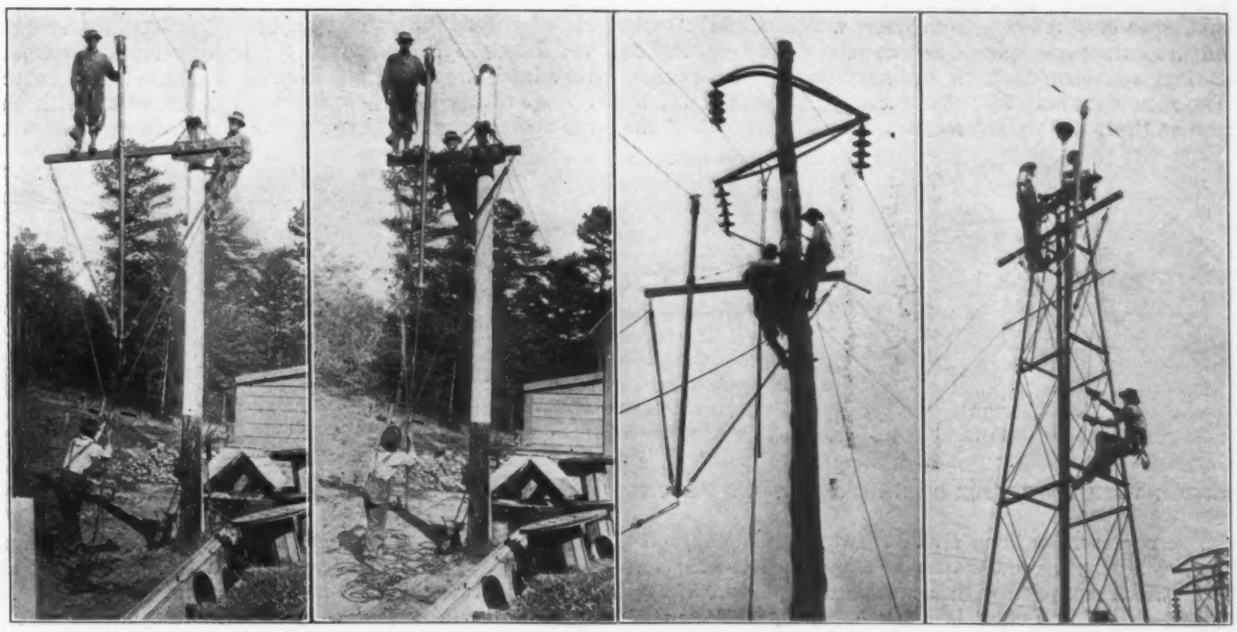
The transmission-line clamp also makes it possible to work out a system whereby there need be no communication between operating and line departments after notice has been given the latter-named departments of a "knock-out" on the line. It also relieves the linemen from any danger resulting from mistakes on the part of operators while repairs are being made to a line.

The tap clamp consists essentially of two brass castings. The back casting carries an eye near the top, a loop at the bottom, and a lug with a hole



FIGS. 3 AND 4—SIDE AND FRONT VIEWS OF TAP CLAMPS

drilled in it, in which the wire lead is inserted and soldered or clamped by a set screw. The front casting is held against the back casting by bolts and springs in a simple but rigid manner. To facilitate the use of the clamp, a special switch stick has been developed with which a connection is made as



FIGS. 5, 6, 7 AND 8—LARGE-SIZED AND SMALL-SIZED INSULATOR CHANGERS, AND INSULATOR CHANGER IN USE ON 66,000-VOLT (PULLING COTTER KEY OF INSULATOR) AND ON 50,000-VOLT LINE ON STEEL TOWER

follows: The lead wire is first connected to the dead apparatus or line, and the clamp which is attached to the other end of the lead is then placed on the hook of the switch stick and by means of the stick placed on the live line, where it balances owing to the weight of the lead wire; the hook is then inserted in the loop at the bottom of the clamp, and by a downward pull the clamp is snapped on to the line with a firm grip. It can be removed by placing the hook in the eye of the clamp and pushing it upward. The clamp is made in three types, to take wire varying in size from No. 6 to 750,000 circ. mils.

The strain clamps are designed for solid and stranded conductors varying in size from No. 1 to No. 4/0 inclusive, and are applicable to various kinds of long-span strain service. A clamp can be easily snapped in place, it is asserted, with two switch sticks. The bolts may be tightened with the wrench stick and the springs removed by pulling the cotter keys with the switch stick. The springs are interchangeable with either type of clamp. The strain clamp is utilized in dead-ending live lines, and when properly applied, it is claimed, will not slip.

FIG. 10—COTTER-KEY PULLER

In the accompanying illustrations are shown several types of insulator changers, the largest-sized device being employed on lines with pressures up to 110,000 volts. The necessary adjuncts to an insulator-changing set are the following: Lifting poles of straight-grain, well-seasoned oak, cross-arm saddles with cross-arm bolts and nuts, pivoted guides with nuts, large clevises with bolts and nuts, a ⅝-in. turnbuckle with a hook on each end, trace chain, cross-arms, pole grab fitted with chain, eye-bolts, chain locks and clevises, brass-handled wrenches to fit the eye-bolts which pass through the cross-arms, chain and chain lock to go with the eye-bolts and handles, two-sheave blocks, 500 ft. of 0.5-in. rope, hack-saw mounted on end of pole, forked-switch stick, cotter-key puller, and plain Johnson switch stick with wire cutter. The lifting pole, pole grab, etc., are all fitted with clevises. Two lifting poles are provided with each insulator-changing set, adapting it for different kinds of service. The conductor cannot be removed from the upper end of the lifting pole until it is released by opening one of the jaws with a switch stick. All of the handling is done by ropes from the ground.

The tools and clamps described herewith are being made by Hickey & Schneider, 61 Broadway, New York.

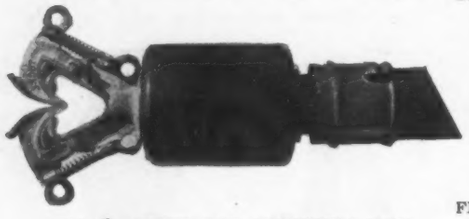


FIG. 9—UPPER END OF LIFTING POLE

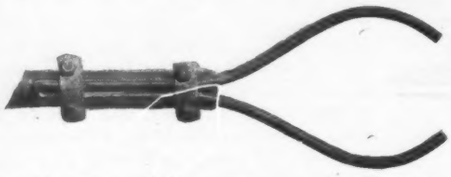


FIG. 11—FORK FOR HANDLING SUSPENSION AND STRAIN INSULATORS

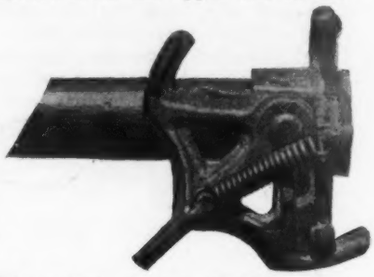
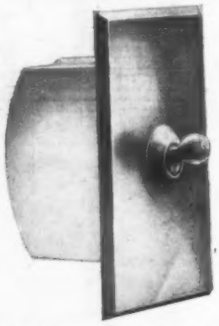


FIG. 12—SAFETY HAND SWITCH STICK FOR HANDLING CLAMPS

Toggle Switch

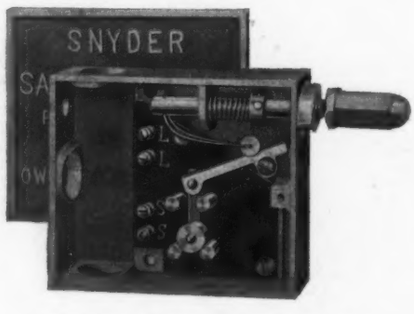
Because of its small plates and toggle the switch shown herewith is especially adapted for use in private houses, apartments, and other buildings where interior detail is carefully planned and considered. The device is convenient in operation on account of the toggle, which may be pushed up or down to close or open the circuit, as the case may be. The switch is simple in construction, but is strong and is designed to last under heavy service. The mechanism is operated by a lever, and since only the toggle member, which is of the same finish as the plate, extends through the plate, the device is less conspicuous than ordinary types of switches. The face plate may be either rectangular, oval or round, and as there are no screw-holes, the development of the device represents a long stride forward artistically. In the accompanying illustration is shown a half-size view of a switch equipped with a rectangular plate, 2.375 in. by 3.5 in. The switch is being made by the Newton Manufacturing Company, Lynbrook, N. Y., in the single-pole, double-pole, three-way and four-way types.



SWITCH WITH TOGGLE FOR OPENING OR CLOSING CIRCUITS

Elevator Door Switch and Threshold Lamp

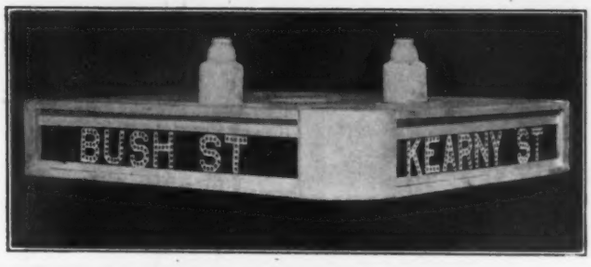
Owing to the fact that a large number of elevator accidents occur at the doors or gates, Owen T. Snyder & Company, Columbus, Ohio, have developed a safety door switch and threshold lamp for eliminating hazards to passengers when leaving and entering the cars. Elevators equipped with the device shown herewith cannot be started unless the door is closed and latched. The threshold lamp forms part of the equipment and is automatically cut out of the circuit when the door is closed and latched. The manufacturer has also brought out a single-throw switch for locking elevators where threshold lamps are not desired, a single-throw switch for operating a threshold lamp in connection with the car switch, a single-throw and double-throw switch with cam attachments for use on fire doors and safety gates, and a double-pole emergency switch for cutting out all door switches and signaling the car out of service. In connection with these switches solenoid-operated safety locks are provided for elevators operated by lever, wheel or hand cable.



SAFETY DEVICE FOR ELEVATORS

Illuminated Street Signs in the Curb

A new type of street sign installed on trial in San Francisco is placed in the vertical faces of the curb at street intersections and shows the letters illumined after dark, as illustrated herewith. Three 25-watt tungsten lamps are placed in a metal box behind each name

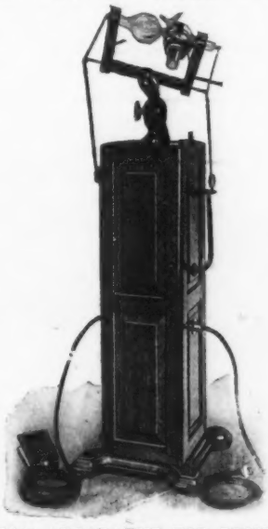


ELECTRIC STREET SIGN IN CURB

plate, the wires being connected to the nearest street-lighting circuit. The glass behind the openings in the letters consists of a single piece. To make the lamps accessible, a removable top plate is provided which can be taken off by removing three lag screws. A sign of the type shown has the advantages of being out of the way and well protected and can be made more legible than other kinds of street signs. Of course, these signs are adapted for use only where there is no snowfall in the winter. The signs are being made by the Illuminated Sidewalk & Street Sign Company and the Universal Patent Day and Night Street Sign Company, San Francisco, Cal.

Radiographic Unit for Dentists

In the accompanying illustration is shown an X-ray machine designed particularly for use by dentists. By means of this machine it is claimed that the dentist can determine whether he has completely filled root canals and that he can locate infected and necrotic areas, unerupted and impacted teeth, pyorrhea and other pathologic conditions. To make an exposure the X-ray bulb is swung into position and a small film is placed in the patient's mouth. The floor switch is then pressed for

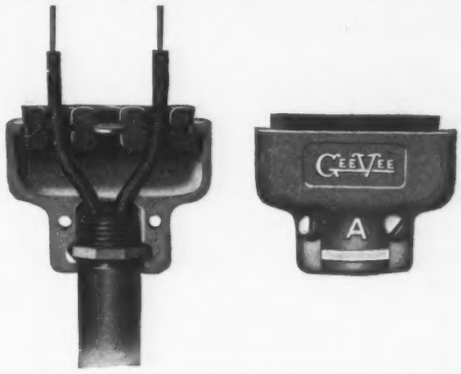


X-RAY APPARATUS FOR DENTISTS

one or two seconds. To develop the film the developing and fixing powders are dissolved in separate glasses and the material is taken to a darkened closet where the films are immersed for a few minutes, after which they are ready for inspection. The generating cabinet, the tube stand and the protecting shield are combined into one piece of apparatus, which occupies a space 18 in. square. A special X-ray tube of lead glass with a sodium-glass window through which the beams of rays emerge is employed. As an extra protection it is provided with a heavy lead-rubber blanket on the back and a heavy lead-glass extension in front of the window. The extension carries an aluminum filter and enables the operator to know the direction of the ray in relation to the part being radiographed. The regulation of the tube, it is claimed by the manufacturer, is automatic, thereby saving time, avoiding breakage of the tube, and insuring uniformity of results. The apparatus is being made by the Waite & Bartlett Manufacturing Company, 252 West Twenty-ninth Street, New York.

Wiring Terminal

A terminal for capping the ends of conduit as shown herewith has recently been brought out by the Gillette-Vibber Company, New London, Conn. The terminal consists of two castings, as illustrated in Fig. 1, which are held together by screws shown in Fig. 2, and a two-



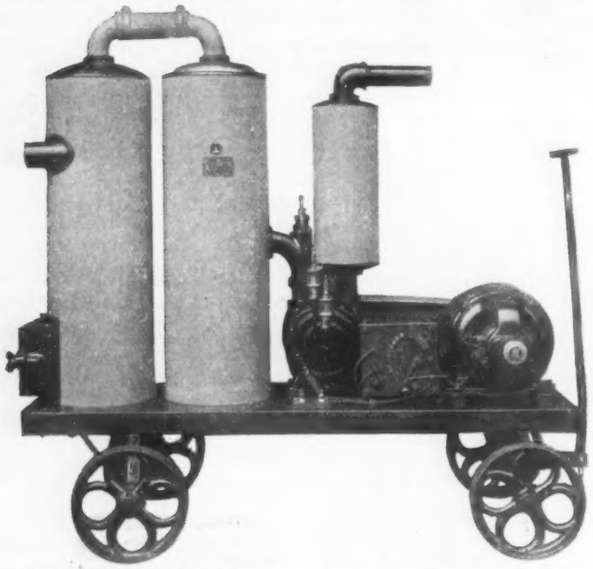
CONDUIT TERMINAL WITH COMPOSITION INSULATOR

piece, three-hole molded insulator. It is being made in three sizes. The holes in the two smallest insulators are 5/16 in. in diameter and will take three No. 8 rubber-covered stranded wires. The holes in the largest insulator are 0.5 in. in diameter and will take three No. 4 rubber-covered stranded wires. A lock-nut is screwed on the end of the conduit before placing the terminal in position. The castings of the device, which is designated as the "Gee Vee" terminal, are galvanized.

Vacuum Cleaner for Use in Factories

Certain improvements have been made in the portable vacuum-cleaning apparatus shown herewith and made by Hanlon & Wilson, Wilkinsburg, Pa. The outfit is especially adapted for use in factories and, according to the manufacturer, is being successfully used in white-lead factories for collecting white-lead dust and other lead products, storage-battery factories for gathering lead dust incident to the manufacture of storage batteries, automobile factories for the collection of dust in the varnishing rooms and drying ovens, corset factories for the collection of textile clippings and dust, silk mills for collecting dust and lint, etc. The "Vak Klean" outfit, as it is called, consists of a rotary pump, a double-tank dirt separator, and a motor mounted on a truck as shown. Eighty-five per cent of the dirt collected is deposited in one of the tanks of the separator. The fine dirt and dust are carried with the air to the second tank, where the air is filtered before passing to the pump, the fine dirt being caught by bags. The drive is by silent chain. The apparatus is being made in two sizes, the No. 1 outfit being operated by an 0.5-hp. motor on direct

current and an 0.75-hp. motor on alternating current, and the No. 2 outfit by a 1.75-hp. motor on direct current and a 2-hp. motor on alternating current. The No. 1 machine has an air displacement of 35 cu. ft. and gives a vacuum (mercury column) of 12 in. The pump of the outfit operates at 875 r.p.m. It is 36 in. high, 44 in.

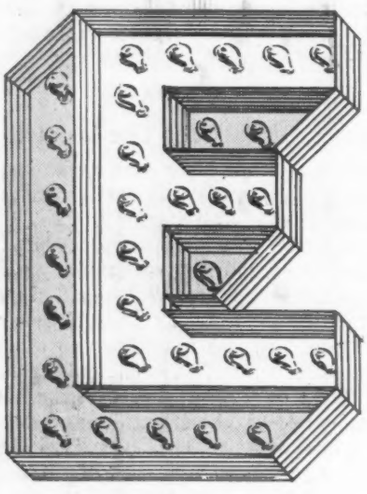


PORTABLE MOTOR-DRIVEN FACTORY VACUUM CLEANER

long and 15 in. wide, and weighs 300 lb. The No. 2 outfit has an air displacement of 75 cu. ft. and gives a vacuum of 16 in. The speed of the pump is 875 r.p.m., the height 52 in., the length 60 in. and the width 28 in. The outfit weighs 850 lb. Various attachments are provided for different cleaning purposes.

Shaded Electric Sign Letter

Patent rights have been secured on electrically shaded letters for electric signs by A. J. Conner of the Thomas Cusack Company, Indianapolis, Ind. Clear lamps are used in the letter portion of the sign and col-



ELECTRIC-SHADED LETTER

ored ones in the shaded portion, as indicated in the accompanying illustration. The flashing of letters and shaded portions gives a number of varied effects. The system permits a soft shading in different colors of lights and the use of signs with various combinations of colors.

Cane and Umbrella with Flashlamp Attachment

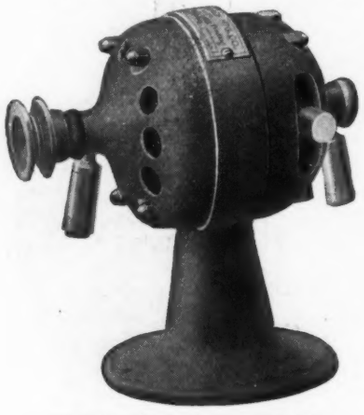
An adaptation of the flashlamp to a useful and at the same time novel purpose has been made by inserting lamps in the handles of canes and umbrellas as shown herewith, thus enhancing the value and the desirability of these necessary articles as gifts. The battery can be easily replaced, and the circuits may be closed at any

ELECTRICALLY ILLUMINATED UMBRELLA

time by pressing the button below the handle shown in the illustration. The Lincoln Electric Works, 112 West Adams Street, Chicago, Ill., are placing the above-described novelties on the market.

Motor for Jeweler's Lathe

A motor, 5.5 in. long by 5.5 in. high, weighing only 2.5 lb., has been developed by the Hamilton-Beach Manufacturing Company, Racine, Wis., particularly for operating jewelers' lathes. It is designed to run at speeds varying from 5000 r.p.m. to 10,000 r.p.m. It may be reversed by turning the button in the switch, and the speed regulation is so arranged that when the motor is running at high speed in one direction and is reversed it will run at slow speed in the opposite direc-



JEWELER'S LATHE MOTOR

tion, making it especially useful, it is declared, to the manufacturing jeweler for drilling and tapping purposes. Motors of the type shown are being made for alternating currents at pressures of from 110 volts to 120 volts and for twenty-five cycles to sixty cycles, and for direct current at from 100 volts to 120 volts.

Electric Timing and Program System

An electric timing and signaling system, consisting essentially of a master clock to which is attached a metal-disk program for operating one or more circuits of bells and as many secondary clocks as desired, is being placed on the market by the Betts & Betts Corporation, 256 West Fifty-fifth Street, New York. The principal parts of the master "Klok" movement are the winding motor, worm gear, contact for winding motor, arbor for opening winding circuit, arbor for closing winding circuit, closing cam, and circuit closer for minute contacts. The master clock is wound only three times in twenty-four hours. The winding motor is directly connected and gives a complete winding in less than one second. Four dry cells operate the motor for from fourteen months to eighteen months. The secondary clock is positively locked, the manufacturer points out, after the master clock has closed the circuit. The secondary clock is also locked when the circuit has been opened by the master clock. The mechanism of the master clock is shown in Fig. 1. In Fig. 2 is shown the metal disk employed in operating one or more circuits of bells at prearranged intervals. The metal disk revolves once in twelve hours, the small disk silencing the bells at night. Each concentric row of holes represents a circuit. The program changes are accomplished by simply inserting a sterling silver pin in the hole corresponding to the minute the ring is desired. The self-winding master clock, which is equipped with the metal-disk program, measures 70 in. high, 18 in. wide and 7 in. deep. It has a sixty-beat movement and a 14-in. dial.

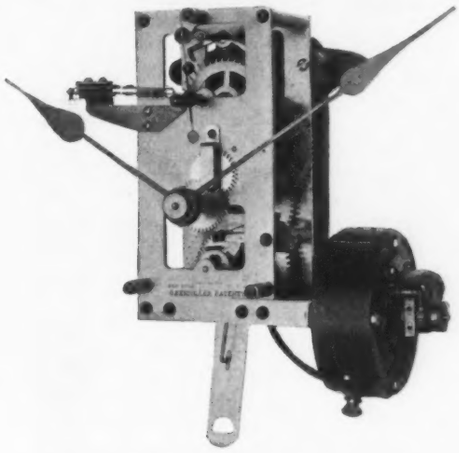


FIG. 1—MOTOR-CLOCK MOVEMENT

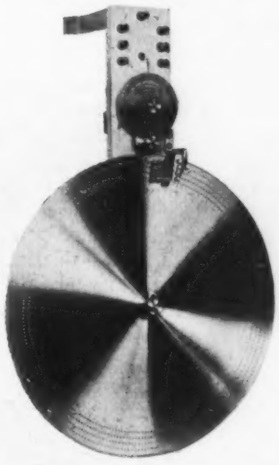


FIG. 2—METAL DISK FOR OPERATING ONE OR MORE BELL CIRCUITS AT PREARRANGED INTERVALS

Protected Tree Wire

For use near trees or in places where the covering of a wire may be subjected to severe abrasion, the Simplex Wire & Cable Company, 201 Devonshire Street, Boston, Mass., has recently developed its "Fibrex" tree wire. The essential feature of the tree wire is the covering, which consists of tarred jute, non-metallic armor and weatherproof braid. This protection is designed for use with any type of cable either of the single-conductor or multiple-conductor type. For instance, with a No. 6 solid-tinned copper wire for 2300-volt service there is first a layer of rubber 11/32 in. in diameter; next comes a layer of tape, then a serving of tarred jute; next a specially treated fiber tape wound on spirally, and finally, on the outside, heavy weatherproof braid.

Electric Grinder for Steel Mills

A grinder which is connected by means of a flexible shaft to a small motor mounted on a truck, as shown in the illustration, has recently been brought out by the Stow Manufacturing Company, Binghamton, N. Y. The grinder has been especially developed for use in the steel industry and allied trades. The motor is entirely inclosed, and the starting equipment is incorporated within the motor frame, thus giving compact construction. In the direct-current equipment the variation in speed is secured by means of a plunger in the pole piece. The manufacturer claims that full-load efficiency remains practically the same at all speeds, and that the machine can withstand sudden overloads without dangerous sparking. The motor is so balanced on the truck that it may be adjusted to the proper angle for all purposes, it is asserted, and to meet all grinding conditions. A long arm is provided for taking the weight of the flexible shaft. The grinder may also be operated by an alternating-current motor. The tool is being built in several sizes, according to the capacity of the emery wheel desired.

GRINDER OPERATED BY MOTOR THROUGH FLEXIBLE SHAFT

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

FEDERAL WATER-POWER LEGISLATION

Secretary of the Interior Outlines Its Scope in His Report and Also Gives Data on the Patent Office

The annual report of Franklin K. Lane, Secretary of the Interior, goes into a number of subjects of interest to the electrical industries, among them the subject of water-powers. At the same time his report was made public there were also made public abstracts of the reports of the Patent Office and other bureaus.

With reference to water-powers, Secretary Lane says:

"How many of these there are on public land not yet disposed of no one knows, but we have several hundred under withdrawal, which should be freed from withdrawal and turned into use just as quickly as possible; for, as the muscle of man or horse can raise a few barrels of water from the well to supply stock or irrigate the garden patch, so can the power of the stream, turned into electricity, be used to raise millions of barrels of water to irrigate alfalfa farms or orchards. And this is now one of the most common uses of electric power in the West. Then, too, there is that mystifying miracle of drawing nitrogen from the air for chemical use, which can be done only with great power, but is being done in Germany, Norway, Sweden, France, Switzerland and elsewhere, by which an inexhaustible substitute for the almost exhausted nitrates of Chile has been found.

The Ferris Bill

"Accompanying the general development bill in its passage through the House was a measure intended to promote hydroelectric development on public lands, named after the chairman of the public lands committee of the House, Mr. Ferris. This bill was called for by the fact that existing legislation permitted only a revocable permit to be granted for such use, and this was regarded by engineers and financiers as too tentative and hazardous a tenure where millions of money were needed for the installation of the necessary plant.

"The Ferris bill meets this difficulty by proposing a lease of these lands for a definite term of fifty years. The objection is made that the lands should be given outright. To this there are several answers of substance: No enlightened government gives such a franchise. There is danger, very real danger, too, of a complete monopolization of such power sites if the lands go forever from the people. The value of water-power is not yet fully realized, and its full value cannot be known at this stage in our industrial life. The purpose of the government in transferring these lands is to secure their use because it does not choose to use them itself, but the time may come when it may be most desirable to the full development of our life that they shall be operated by the nation or the States or the municipalities in the States, and to transfer them forever would cast a burden upon the future which would be unforgivable and is, moreover, unnecessary. The people desire these lands used, not held as a mere basis for speculation in stocks or bonds. Where there is need for such a plant the lands should be available on most generous terms.

"The State owns the water, it is said, and should therefore command the right to the use of the land. This line of reasoning leads to an *impasse*. We are not considering rights, but what course is wise. Quite plainly the State cannot command the use of the land and it is not proposed that the nation shall command the use of the water, for no one can have the land at all unless he first gain the right to use the water from the State. We have given no other land to the State except for the sustaining of schools and colleges or for reclamation. If a State wishes coal land, it must buy it. The traditional policy of the government has been to deal directly with the people in disposing of their domain.

"The fear is expressed that by the imposition of charges for the use of the land an undue and unjust burden will be cast upon the people. The basis of this fear has not been discovered. Congress may, of course, if it so desires, fix absolutely the charge that shall be made, and if this were done the charge should be so low as to make the added burden upon the consumer, if any, an infinitesimal one; perhaps first a free period when no charge would be made, and then 0.1 mill per kilowatt-hour for a period and 0.2 mill later.

"As already said, with the passage of these two measures there will be no land or resource that will not be at the full service of the people. And yet the romantic enterprise of revealing America will not be done. To get from our resources their fullest use—this is our goal. And this is nothing less than a challenge to the capacity of a democracy."

The Work of the Patent Office

As to the Patent Office, Secretary Lane's report says:

"During the fiscal year ended June 30, 1915, there were filed 66,497 applications for patents for inventions, 2679 applications for design patents, 173 applications for reissues, 8376 applications for registration of trademarks, 947 applications for labels, and 444 applications for prints, the total number of such applications being 79,116. In addition, 1938 appeals and twenty-six disclaimers were filed. During the year there were granted 44,402 patents (including 1489 designs and 179 reissues), 6919 registrations for trademarks, 762 registrations for labels and 321 registrations for prints. The number of patents which expired during the year was 20,992. The number of allowed applications which were forfeited for non-payment of final fees therein was 11,882.

"The total receipts of the office were $2,270,937.68, and the total expenditures for all purposes were $2,087,581.26, the net surplus of earnings over expenditures being $183,356.42 for the year, with a grand net surplus of $7,714,316.62 since the establishment of the present system in 1836.

"For the first time in years the office disposed of as many applications as were received, although the number of applications filed has not fallen off. During the years 1912 and 1913 there were filed 8000 more applications per year than were disposed of.

"The total number of applications awaiting action June 30, 1914, was 22,283. On June 30, 1915, there were 18,270, a decrease of 4013.

"The number of patents granted in 1914 was 38,225, and the number in 1915 was 44,402, an increase of 6177.

"There was a reduction in the number of interferences declared from 1129 in 1914 to 916 in 1915—a decrease of 213."

PRESTIGE IN ENGINEERING PROFESSION

American Association of Engineers in Convention Discusses Means of Improving the Status of the Engineer

More than 100 engineers put in touch with positions at no cost to the engineer or employer, thereby saving them about $3,000, all at a total cost of less than $2,000, is the gist of the report of the activities of the service clearing house of the American Association of Engineers, presented by the secretary at the first annual convention held in Chicago, Dec. 10 and 11. The $2,000 represents all the money spent since this organization, devoted to the welfare of the engineer, started its existence seven months ago, and the work of the clearing house has practically all been done since Sept. 15.

The organization has now about 300 members, and it received forty additional applications at the Saturday afternoon meeting, attended by 400 engineers, 200 of whom were visitors.

In an address by J. H. Prior, chief engineer Illinois Public Utilities Commission, on "The Economic Aspects of Engineering Pay," he demonstrated by diagrams that the pay of the lowest "marginal" man in an organization had a direct effect on that of the most highly paid. He also pictured the law of supply and demand, showing that the same result was obtained in case free bargaining was indulged in and full knowledge of conditions was had by both the engineer and his prospective employer.

The Engineer in Civic Affairs

Prof. F. H. Newell outlined the problems of the engineer from the welfare standpoint. He emphasized the idea that this organization is in no wise antagonizing any other good welfare movement, but will stimulate and help the existing organizations far more than it will draw from their membership. He spoke at length on the duty of the society to the engineer, and suggested that younger men be chosen more often as officers. He likened the material development of the age to a Frankenstein organism which threatens to destroy its creator, the engineer, unless the same type of mind is utilized to control it. He sounded a call to the engineer to participate in the larger civic affairs of the nation, and said: "It will not do to view imperfect public affairs from the outside. We must get together to help upbuild with high ideals rather than to call attention to the defects and deficiencies of other organizations or of existing conditions."

Advancement for the Man Between

Garrison Babcock, a consulting engineer, delivered an address on "Advancement for the Man Between." From a commercial standpoint, he said, the engineer is surrounded by commercial organizations which strive to advance the dealer and laborer. How about the designer? He is essential to both capital and labor and yet receives no place in the councils of either. He scorns to ask a place in either, and both are too busy with their own affairs to extend unnecessary invitations to a class which is represented by the "man between."

Engineers have clubs, societies and associations, so called, which are devoted to everything except the welfare of engineers as a professional body. These organizations are certainly useful in making our technical schools modern and more comprehensive, but they fail to afford a broader field for the individual or to make the engineer's lot a better one. Some think that they narrow the engineer's vision into a groove which restricts opportunity. It is certain that there is a spirit of independence, if not indifference, separating the various engineering societies which robs the technical professions as a whole of much prestige.

Engineers are confronted with a situation where science has a recognized place in all industries. The colleges are discharging an army of men with diplomas into the field every year. Engineering successes receive small note and engineering failures are thrust upon our notice repeatedly, while the cause for such failures may rest upon lack of engineering qualifications. We are individually trained to recognize and apply the highest degree of economics, and yet we raise no voice when our employer, our nation, our State or our city employs the most extravagant and wasteful methods and practices. Why this silence? Professionally we have no vital organs. Our birth is not complete. We must generate vocal chords and a heart. We must build our body as for an athletic event. Then what can we do? We can help labor work to a better advantage, aid our employers in becoming supplied with better engineering skill, and assist our country to compete with the world and "to reap two blades in its field of natural resources where but one now thrives." As a logical result, our family will prosper to the fifth generation, which in this instance means undergraduate, graduate, engineer, chief engineer and consulting engineer.

CONCEALED PLANT FOR NIAGARA FALLS

Hydroelectric Association Advocates Construction of 100,000-hp. Municipal Station in State Park Reservation

The construction of a concealed municipal hydroelectric plant on the State Park Reservation at Niagara Falls, N. Y., costing approximately $4,000,000, to supply additional electrical energy to the cities and towns in western New York, is advocated by the Hydro-Electric Association of Niagara Falls, of which M. Arnson is president. A bill calling for State development of additional electrical energy at the Cataract City is now being drawn under the direction of a special committee of the association to be considered at the next meeting, on Jan. 18, 1916, and ultimately to be presented to the New York State Legislature for its approval.

The proposed plan is being presented to the Mayor-elect and the new councilmen at Niagara Falls and to the mayors, boards of trade and business men's associations throughout western New York, as well as to the conservation commission, the superintendent of public works and the State engineer, the Secretary of War, and representatives in Congress from western New York. The tentative details of the proposed plan indicate that it is intended to meet the requirements of the State Park Reservation Commission for preserving the natural scenery and beauty of the Niagara River and the park, as well as those providing for the highest efficiency of Niagara power development that are contained in the Cline bill, now in the committee of foreign affairs of the House of Representatives at Washington, D. C.

Necessary legislation is urged at Washington by an amendment to the Cline bill, as follows:

"Permission is hereby granted to use 4400 cu. ft. of water, to be taken above the falls of Niagara, provided that the State of New York, or some political subdivision thereof under authority of the State, develop the same for the benefit of the people."

The necessary legislation at Albany is urged to provide for the utilization by the State of New York of the 4400 cu. ft. per second available under the treaty, together with 600 cu. ft. per second allowable under the treaty for combining with the sewage of the city of Niagara Falls for sanitary purposes, in order that the municipality may cease discharging its sewage over the lower cliff in the present unsanitary and wasteful manner, while at the same time not wasting the water

but developing auxiliary hydroelectric power by a special penstock in the proposed State power plant. The 4400 cu. ft. and 600 cu. ft. per second would give a total of 5000 cu. ft. per second available at the head of 212 ft., and with an efficiency of from 75 to 85 per cent this would give a maximum capacity of 100,000 hp. for a State power plant.

Near the front of the power house would be installed eight or ten 12,000-volt, three-phase, twenty-five-cycle electric generators, each directly coupled to double horizontal hydraulic turbines of 10,000-hp. to 12,000-hp. rating, operating in arched steel and concrete-lined chambers excavated in the Niagara River bank, and connected by eight or ten steel penstocks down which the water would pass and, after developing the great power, discharge from the turbines into draft tubes and a tailrace tunnel under the power house into the lower river. An auxiliary penstock would receive the 600 cu. ft. per second or such part of it as was added to the sewage of the city of Niagara Falls by its reorganized sewer system, developing several thousand horsepower for such service as might be desired.

The power-house front extending 160 ft. along the river bank, with its observation galleries, would be connected by passenger elevators in the penstock pit. The water would be delivered to the penstocks through two large steel and concrete hydraulic conduits just beneath the surface of the park, which would convey the water from the intake in the upper river in the same manner as the 18-ft. steel pipes convey the water of the Ontario Power Company beneath the surface of the Canadian Victoria Park.

Among other things, the association points out that there is no reason why the proposed concealed power plant could not be erected for $33 per horsepower, which was the construction cost of the American Cataract Power Company's plant. It is figured that the plant could be operated for $5 per horsepower per annum.

The question of transmission and distribution has been carefully figured on, and the association finds that the power could be handled through a municipal substation near the foot of Porter Avenue in Buffalo and distributed to all the cities and towns in western New York for less than the present charges of other power companies.

The Broader Features of Regulation

"The Need of a Consistent State Policy in Dealing with Public Utilities" was the title of an address made before the Portland Section of the N. E. L. A. at its regular luncheon on Dec. 9 by Mr. Clyde B. Aitchison of the Public Service Commission of Oregon. Mr. Aitchison dealt with the subject in a broad and constructive manner, pointing out many of the objectionable features of the present non-comprehensive plan of regulation.

Mr. Aitchison characterized the present system as having no connected, strongly defined plan of control. He stated that there was no developed, well-formulated idea of what the State should require from the utilities. Hair-trigger solutions of existing problems often meant only an apparent solution, with a real solution rendered more difficult in the future. Mr. Aitchison believed that the State should concern itself, broadly, with four features of regulation, namely, the granting of the franchise, the financial standing of the utility, the character of the service, and finally the rates. He deplored the system of franchise grants at present in vogue in most States. This system left the matter almost entirely to local officials, who often, through ignorance or selfishness, imposed burdens on utilities that were in turn shifted to other communities. Some standard system of franchises should be worked out so that a little hamlet would not have it in its power to block a general plan of development that might mean a great deal to a neighboring metropolis.

He contended that the public utility business was really one delegated to the companies by the State, and as long as the State found it advantageous for companies to do the work, the State could reasonably be expected to keep out of the game, but the State always reserved the right to do the work itself on its own account any time it saw fit. Looking at the matter in this light, it became apparent that the State had no right to delegate the utility business to a corporation that was not sufficiently well financed to continue to operate. The speaker contended that wasteful competition was a source of great expense to the public, and stated that it was his belief that interest charges on utility securities of at least 1¼ per cent might be attributed to this feature of the business. Thus the consumer would be ultimately benefited if wildcat competition could be eliminated. Mr. Aitchison's talk was particularly interesting because of his remarks on matters of temporary expediency. He stated that, as a general thing, unwise policies causing immediate benefits were eventually paid for in full with compound interest.

The meeting was presided over by John A. Laing, general attorney for the Pacific Power & Light Company, and ninety members were present.

Emergency Service in Forty-five Minutes

On the evening of Dec. 10 a steam pipe under pressure burst, filling the entire cellar of the New York Athletic Club building on Fifty-ninth Street, New York City, with steam and causing the building's generating plant to shut down, leaving the club in darkness. The New York Edison Company was asked to supply emergency service until repairs could be made, although no breakdown connection was available in the building. Emergency connections were made in the nearest manhole, and the lamps in the club house were again giving light forty-five minutes after the company had been notified of the accident. Repairs to the club's power plant were made while the Edison system was carrying the load, and the emergency service was discontinued at 10 o'clock on the following morning.

Rate Reduction in St. Louis

The Union Electric Light & Power Company of St. Louis announced on Dec. 9 that it had reduced the first step in its schedule of residence rates from 10 cents to 9 cents a kilowatt-hour. This reduction was made in keeping with a promise of Aug. 13 to reduce the first step to 9 cents when the company had 65,000 consumers on its books. The company announced that it had gained nearly 5000 consumers since August.

No change in the second and third steps of the rate was made. The second step will remain at 6 cents and the third step at 3 cents a kilowatt-hour. The company repeats the announcement made in August that it will reduce the first step of the residence rate to 8½ cents a kilowatt-hour when it acquires 70,000 customers and to 8 cents when it has 75,000. The 5 per cent discount for the prompt payment of bills applies to all rates. It is stated that the average net rate of the company will be about 6.5 cents a kilowatt-hour on the residence business.

Losses Paid by Southern California Edison Benefit Fund.—The mutual benefit fund established by the employees of the Southern California Edison Company five years ago has paid losses totaling $21,699. The average payment has been $943.

Cincinnati Wants Prosperity Week Lights to Be Permanent.—A movement has been started to have the four clusters of lamps on Fountain Square, Cincinnati, Ohio, erected in connection with Electrical Prosperity Week, permanently maintained by the city.

Growth of Electricity Supply to London in Twenty Years.—The energy sold in London, exclusive of that used for traction, has increased from 14,206,900 kw.-hr. in 1894 to 334,442,700 kw.-hr. in 1914. The average rate per kilowatt-hour in 1894 was 12 cents, and in 1914 it was 4 cents.

New Radio Stations.—Three new government land radio stations, at Fort Constitution, N. H.; Fort Dade, Fla., and Fort Moultrie, S. C., eight new ship stations, three of which—on the Alaska, Mackinaw and North America—are designated as for the general public, and five additional special land stations, are mentioned in the December issue of the *Radio Service Bulletin*.

Electric Drive in Textile Mills.—The complete cost of electrical equipment for textile mills, according to J. R. Olnhousen, is about 10 per cent of the complete cost of the mill. The annual cost of power is from 4.5 to 5 per cent of the total cost of manufactured products. Experience with up-to-date motor drive shows an increased production over mechanical drive of from 5 to 7.5 per cent.

Platinum Deposits Discovered in Spain Larger Than Those of Russia.—Professor Orueta stated in an address before the Society of Civil Engineers of Spain that he had discovered in the Ronda Mountain Range, in Spain, platinum deposits of greater extent and richness than those of the Ural Mountains, in Russia, which now furnish about 90 per cent of the world's supply of platinum.

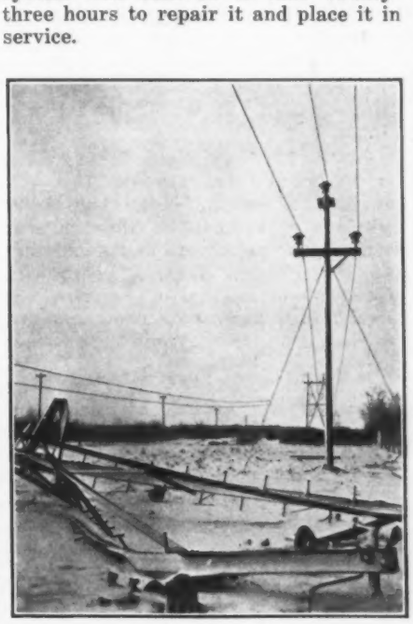
Free Electricity for Demonstrating at Topeka Electric Show.—The Topeka (Kan.) Edison Company has decided to furnish free electricity for demonstrating purposes at the combined electric show and midwinter exposition, which is to be held in Topeka in January. The company's only charge for energy used at the show will be for that used for general lighting and decorative purposes.

Chattanooga Favors Electric Signs.—Chattanooga, Tenn., is planning to adopt a new sign ordinance which will favor electric signs by restricting the use of any other kind which extend out over the sidewalk. Mayor Littleton stated at a meeting of the commissioners that "the dynamo of Dixie," as the city is called, ought to have more electric signs, so as to live up to its name, and added that a big electric sign over the city hall would be a means of arousing interest in the proposition. This matter is now being investigated.

NOTES
ON ELECTRICAL TOPICS

Consumers' Power Acquires Dell Rapids Property.—The Consumers' Power Company has acquired the property of the Dell Rapids (S. D.) Light & Power Company and is now operating it as a portion of the Sioux Falls division. A 9-mile transmission line is being built from Sioux Falls to Baltic, the location of a small water-power and steam reserve which formed the source of the electric supply for the Dell Rapids system, being connected with the town of Dell Rapids by a 5-mile transmission line. Upon completion of the transmission line under construction the water-power and steam station at Baltic will be dismantled and all power furnished from the Sioux Falls station.

Winnipeg Sleet Storm Brings Down Tower.—A sleet storm in Winnipeg, Canada, early last month, resulted in the breaking down of one tower on the lines of the city's municipal transmission system, about 30 miles from the city, and caused about 2 miles of wire to be thrown off the towers of this system. The transmission line of the Winnipeg Electric Railway Company was broken in two places, but the damage, which was not serious, was repaired in a short time. The weather conditions were exceptional for that region, the sleet being of such thickness on the wires that the over-all diameter exceeded 2½ in. The cables of the municipal system have a total area of 278-600 circ. mils and are strung on towers such as the one shown in the accompanying illustration, spaced 600 ft. apart. The insulators are of the pin type and the wires are spaced on 6-ft. centers, there being six conductors per tower. The damage to the municipal system was such as to take twenty-three hours to repair it and place it in service.



TOWER ON WINNIPEG MUNICIPAL SYSTEM BROUGHT DOWN BY SLEET

Wireless Messages from Moving Autos.—A report from Stockholm announces that two Swedish army officers have invented an apparatus with which wireless messages may be sent from fast-moving automobiles or trains.

Connecticut Utilities Pay $48,000,000 in Dividends.—Connecticut public service corporations for the fiscal year 1915 paid in dividends a total of $48,221,298, or $3,756,328 less than last year. Corporations under the Public Utilities Commission's jurisdiction have $827,-949,849 invested in plant and equipment, $810,911,429 in securities, $944,859,147 capital stock outstanding, and $545,472,-260 funded debt. The aggregate surplus on June 30 was $146,151,287.

Volta Plant of Montana Power Company Completed.—Completion of the Volta plant of the Montana Power Company at the Big Falls of the Missouri River has been announced. This power plant, which has a rating of 91,600 hp., of which 61,600 hp. is now available, is the largest of the hydroelectrical developments of the company. The efforts of the company have been directed toward rushing it to completion to furnish the additional power that will be required for operation of the first division of the Chicago, Milwaukee & St. Paul Railroad and other large power requirements. The construction of the Volta plant has taken more than three years. In the main dam, gate sections and abutments over 200,000 cu. yd. of concrete was used, 250,000 barrels of cement was required, and over 3000 tons of steel was utilized.

Customers' Deposits Held by California Utilities.—The putting into effect on Dec. 1 of the order of the California Railroad Commission ordering water, gas, electric-light and telephone companies to return to consumers the deposits the companies held as security for the payment of bills makes timely a list of the amounts of these deposits held by electric utilities as reported by them to the commission as of Jan. 1, 1915: Pacific Gas & Electric Company, San Francisco and vicinity, $396,129.44; Great Western Power Company, San Francisco, Oakland and Sacramento, $343.90; Los Angeles Gas & Electric Company, Los Angeles, $83,001.35; Pacific Light & Power Company, Los Angeles, $48,831.16; Southern California Edison Company, Los Angeles, $92,-051.86; San Diego Consolidated Gas & Electric Company, San Diego, $43,-223.23; San Joaquin Light & Power Company, San Joaquin Valley, $30,-980.18; Southern Sierras Power Company, Riverside and San Bernardino Counties, $18,379.20; Western States Gas & Electric Company, Stockton, Eureka, etc., $17,682.27; Nevada-California Power Company, $31,506.25; Coast Counties Gas & Electric Company, Santa Cruz, $5,630.70; Coast Valleys Gas & Electric Company, Salinas Valley, $2,290.28; Mount Whitney Power & Electric Company, Tulare County, $1,454.35; Northern California Power Company, Sacramento Valley, $736.90; Oro Electric Company, Oroville, $2,556.73; Santa Barbara Gas & Electric Company, Santa Barbara, $17,-498.24.

Chicago Jovians Elect Officers.—The Chicago Jovian League has elected E. W. Donoho first tribune and J. C. Manley second tribune for the coming year.

Philadelphia Jovian League.—At the regular meeting and luncheon of the Philadelphia Jovian League, at the Hotel Adelphia, on Dec. 16, Dr. Philip H. Moore spoke on "How to Sell Goods and Make Friends from the Customers' Viewpoint."

Chicago Electric Club-Jovian League.—At the meeting of the Chicago Electric Club-Jovian League on Dec. 14 John Z. White spoke on "Free Trade, the Basis of Universal Peace and National Prosperity." Lieutenant Farwell of the Naval Training Station near Lake Bluff, Ill., will address the Dec. 21 meeting.

New York Jovian League.—The regular meeting and luncheon of the New York Jovian League was held at the Hotel Martinique, on Dec. 15. The speaker of the day was Ell C. Bennett, Mercury of the order, who outlined some of the plans of the present administration for increasing the efficiency and building up the Jovian body.

Worcester Polytechnic Branch, A. I. E. E.—At the Dec. 17 meeting of the Worcester (Mass.) Polytechnic Institute branch of the American Institute of Electrical Engineers Edwin B. Katté, chief engineer in charge of design, construction and operation of the New York Central lines, delivered an illustrated lecture on "The Electrification of the Grand Central Terminal."

Council Meeting of I. E. S.—A meeting of the Council of the Illuminating Engineering Society was held in the general offices of the society, New York, Dec. 9. Dr. E. P. Hyde, director of the Nela Research Laboratory, Cleveland, was appointed chairman of the committee on lectures. The society is arranging for a course of lectures in illuminating engineering to be given in the fall of 1916. The University of Pennsylvania has invited the society to give the course at that institution. W. A. Durgin of the Commonwealth Edison Company, Chicago, was appointed chairman of the membership committee.

Officers of the Electric Club-Jovian League of Chicago.—Election of officers at the meeting of the Electric Club-Jovian League of Chicago on Dec. 9 resulted as follows: President, V. H. Tousley, chief electrical inspector for the city of Chicago; vice-president, H. A. Mott, Chicago Telephone Company; second vice-president, J. C. Manley, assistant construction superintendent of the Commonwealth Edison Company; treasurer, Howard Ehrlich, associate editor *Electrical Review and Western Electrician;* secretary, L. C. Spake, assistant editor ELECTRICAL WORLD; trustee for one year, J. N. Pierce, president of the Pierce Electric Company; trustee for two years, A. J. McGivern, supply sales manager for the Manhattan Electrical Supply Company; trustee for three years, R. I. Phillips, secretary and treasurer of the Pitt Engineering Company.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Pittsburgh Jovian Meeting.—At the Electrical Prosperity Week luncheon held by the Jovian League of Pittsburgh, Pa., on Dec. 2, Dr. Raymond F. Bacon, director of the Mellon Institute of Industrial Research of the University of Pittsburgh, told of the work being done by his institute, particularly in connection with the coal-tar and dye industry, pointing out the great importance of electricity in connection with this industrial work in America, especially since the war began. Norman W. Storer, vice-president of the American Institute of Electrical Engineers and general engineer of the Westinghouse Electric & Manufacturing Company, traced the use of electricity in industrial, commercial and domestic life, and pointed out some of its possible uses in the future.

Convention of Missouri Telephone Association.—The annual convention of the Missouri Telephone Association was held at the Coates House, Kansas City, Nov. 16 and 17, with an attendance of 300. The former officers were re-elected with the exception of the vice-presidents, as follows: President, Houck McHenry, Jefferson City; vice-presidents, A. M. Benedict, Richards; S. D. Thompson, Cameron; C. A. Pratt, Flatt River; H. H. Hallman, Warrenton; treasurer, A. B. Clark, Kansas City; secretary, W. W. Johnson, Jefferson City; membership secretary, G. W. Schweer, Windsor; executive committee, H. C. Todd of Marysville, J. E. Hudson of Columbia, C. M. Boutin of Cape Girardeau, C. J. Myers of Kansas City, S. T. Neill of Clinton, M. L. Golliday of Holden, R. A. Guthrie of Macon, G. V. Ross of Kansas City, and W. H. Bassett of St. Louis.

N. E. L. A. Sections May Affiliate with Gas and Traction Societies.—The N. E. L. A. committee on geographical sections, of which L. D. Gibbs, superintendent of the advertising department of the Edison Electric Illuminating Company of Boston, is chairman, met Dec. 7 in Chicago with representatives of similar organizations in the gas-service and electric-traction fields. The object of the meeting was to work out details of a plant to consolidate much of the work now being done by these various organizations, so that one local geographical section convention will do for all. Those in attendance were J. C. Woodsome, manager Tampa Electric Company, Tampa, Fla.; Herbert Silvester, Detroit (Mich.) Edison Company; Stephen C. Pohe, Pennsylvania Electric Association; E. M. Walker, Union Electric Company, Dubuque, Iowa; E. J. Condon, president Indiana Utilities Company, Angola, Ind.; Thomas Donahue, local manager Merchants' Light, Heat & Power Company, Lafayette, Ind.; Anthony J. Bemis of Elston, Clifford & Company, Chicago, and F. J. Arnold and E. W. Lloyd, Commonwealth Edison Company, Chicago.

New York Electrical Society.—"The Furthest Reach of Electricity in the Musical Arts" was the subject of the 342d meeting of the New York Electrical Society on Friday evening, Dec. 10, at which a number of types of electrically driven pianos and other musical instruments were demonstrated. A small audion amplifier was also on display, and Dr. Lee de Forest, the inventor, described its uses in connection with long-distance wire and wireless telegraphy and telephony and showed how when employed with condensers peculiar musical sounds could be produced. He said that he expected soon to bring out a new musical instrument, the operation of which would be based on the use of the audion amplifier, and predicted that new and unusual musical effects would be produced by it. Joseph F. Becker, chairman of the Commercial Section of the N. E. L. A., told of the active campaign that has been started in New York to educate users and prospective users of electricity regarding the artistic value of electrically operated pianos and described the efforts of the N. E. L. A. and the National Piano Manufacturers' Association to co-operate in furthering the movement. E. A. Sperry, president of the society, also spoke. Several artists were present, who sang and played on the violin to the accompaniment of electric pianos.

Lighting Sales Bureau of Commercial Section, N. E. L. A., Formed.—On Dec. 9 the following committee, which had been appointed by the executive committee of the Commercial Section of the National Electric Light Association, met in Chicago and formed a new division to be known as the lighting sales bureau of the Commercial Section of the National Electric Light Association: J. G. Learned, Chicago, chairman; O. R. Hogue, Chicago, secretary; F. B. Rae, Jr., New York; S. B. Burrows, Newark, N. J.; T. F. Kelly, Dayton, Ohio; H. N. McConnell, New York; A. G. Kimball, Boston; J. L. Wiltse, Brooklyn; Joseph D. Israel, Philadelphia; Fred Scheel, Chicago; N. H. Boynton, Cleveland; C. L. Law, New York; C. M. Masson, Los Angeles; H. C. Porter, St. Joseph, Mo.; G. H. Stickney, Harrison, N. J.; Earl E. Whitehorne, New York; W. A. Donkin, Pittsburgh; A. K. Young, Toledo, Ohio, and F. D. Beardslee, St. Louis. Tentative plans for a working organization were laid out, and the following chairmen of sub-committees were tentatively appointed: Residence lighting, Fred Scheel; store and public building lighting, F. B. Burrows; advertising, A. K. Young; municipal and road lighting, T. F. Kelly; industrial lighting, O. R. Hogue. Another committee, styled the illumination committee, was suggested, but no chairman as yet has been appointed. According to Chairman Learned, "action" is to be the watchword of the new lighting sales bureau.

Public Service Commission News

California Commission

In a letter of transmittal accompanying the annual report of the California Railroad Commission, which appears in print this month, the following figures are given: During the fiscal year ended June 30, 1915, 675 formal applications and 241 formal cases were decided. Valuations made by the commission included the following: Railroad, $97,509,514; water, $37,100,086; electric, $30,851,930; telephone, $8,493,178; gas, $6,961,543; wharf and warehouse, $434,395; total, $181,350,646. Classified under a different analysis these items would be arranged as follows: Rate-making, $66,679,728; issue of securities, $72,360,873; sale and purchase, $5,267,900; general valuations, $37,042,145; total, $181,350,646. In 99 per cent of the formal proceedings decided by the commission its orders have become effective without litigation, while the commission has won all of the last eleven successive cases decided by the court.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has refused an application of the borough of Butler for approval of an ordinance of the township of Pompton granting the borough the right to construct and operate a municipal electric light, heat and power plant and local distributing system. As a basis for its decision, the board sets forth that the act of 1915, under which the ordinance was passed, does not provide for notice to the public of the passage of such an ordinance, and no notice was given either by publication or otherwise.

New York Commissions

The Governor of the State of New York has appointed Oscar S. Straus, former United States Minister to Turkey, afterward Secretary of Commerce and Labor, and progressive candidate for Governor of New York in 1912, as chairman of the Public Service Commission for the First District, to succeed Edward E. McCall, removed.

Wisconsin Commission

The Wisconsin commission has handed down a decision authorizing a slight increase in the rates of the St. Croix Telephone Company. A special study was made of this case with an idea of developing principles of cost apportionment to be used in fixing rates for telephone service. The decision takes up the general question of the influence of the cost of service upon utility rate schedules and outlines the lines along which, it is believed, a telephone investigation should be conducted. The investigation proceeds upon the assumption that until measured service becomes practicable telephone service will continue to be furnished at flat rates and that it will be impracticable, with any given class of consumers, so to adjust charges as to distribute to each user in that class his own share of the variable expenses; further, that it is possible by a traffic study to determine for each class of user the extent to which the service is used and therefore the costs which should be borne by each class. In this connection attention is called to the fact that telephone service is always a service to two consumers, which must be considered in determining unit costs.

The St. Croix Telephone Company furnishes service to five classes of consumers, as follows: Residence, business, local rural, foreign rural, and toll. The first portion of the cost analysis involves a direct allocation of the various expenses to each class of service in accordance with present practice. The second portion takes up the reapportionment of certain of the allocated groups of expenses of the first apportionment from one class of service to another on the basis of use, as indicated by the traffic study, thus dividing the cost as a unit of service between the two consumers who are responsible for it. Several bases of apportionment were used, such as the number of telephones, the number of lines, the number of wire-miles, the total number of rings, the rings per call for each class, the number of originating calls, and the number of terminating calls.

Although the commission was of the opinion that it could not be guided entirely by the costs as determined in the analysis, since the traffic study was taken for a relatively short length of time, it did consider that the results were sufficiently accurate to show which class of rates should be increased and which decreased.

Corporate and Financial

Consolidated Gas, Electric Light & Power Company of Baltimore, Md.—The Maryland Public Service Commission has received an application from this company for permission to issue $2,174,000 of common stock. The stock issue, it is set forth in the application, is for the purpose of retiring the $2,500,000 of 5 per cent gold notes which were issued by the company last March, with the privilege of conversion at the option of the holder into common stock at $115 per share. Now the company wants to retire these notes permanently and desires permission to issue the additional common stock for that purpose. It is stated in the petition that the company wants a supplementary or amendatory order passed authorizing this additional issue of common stock. This is because the original order granted at the time the notes were issued was not sufficiently broad for the purpose. This $2,174,000 par value of stock will at the market price of $115 a share for the common stock equal $2,500,000, the amount of the note issue. It is the first time in the history of the company that its common stock has risen above par.

English Government to Purchase American and Canadian Securities.—The House of Commons on Dec. 13 passed the second reading of the bill empowering the government to mobilize American and Canadian securities by purchasing or borrowing them, to be used primarily as collateral for loans, or, in case of necessity, to be sold to meet Great Britain's liabilities in the United States. The scheme is entirely voluntary, and the Chancellor of the Exchequer, Reginald McKenna, made it clear that the government had no intention of swamping the American market with securities. Mr. McKenna explained that the trade balance in favor of Great Britain had been exhausted by the huge demands made upon America for goods for England and her allies, and the amounts paid in interest on foreign securities held in Great Britain or earned by British shipping were not sufficient to set this right. Consequently, in order to meet liabilities in the United States, the government was obliged to go outside the ordinary course of trade and buy or borrow securities. The Chancellor estimated that the American and Canadian securities held in England were valued anywhere from $1,500,000,000 to $4,000,000,000 and expressed the hope that they would be sufficient "to meet our liabilities and to maintain exchange in the United States for the period of the war."

Great Western Power Company of California, San Francisco, Cal.—Subject to the approval of the California Railroad Commission, the company has sold to New York bankers that portion of $4,500,000 of ten-year 6 per cent convertible gold debentures not subscribed for by stockholders. The debentures are due Nov. 1, 1925, and are convertible from Nov. 1, 1917, to Oct. 31, 1920, at 100 and accrued interest into the company's 7 per cent cumulative preferred stock at 95 and accrued dividends. The earnings for the Great Western power system for the twelve months ended Sept. 30, 1914 and 1915, were as follows:

	1914	1915
Gross earnings	$2,684,042	$2,830,821
Operating expenses and taxes	950,790	833,995
Net earnings	$1,733,252	$1,996,826
Other income	230,282	195,329
Total income	$1,963,534	$2,192,155
Bond interest and dividends on guaranteed stock		1,332,450
Surplus		$859,705
Interest on debentures		270,000
Final surplus		$589,705

Olympic Power Company, Port Angeles, Wash.—The company was placed in the hands of H. E. Sims of Port Townsend and C. L. Haggith of Port Angeles as receivers upon the application of Peabody, Houghtaling & Company, bond merchants, of Chicago, and the Citizens' National Bank of Port Angeles. Thomas I. Aldwell, vice-president and general manager of the company, states that the obligations are largely of a bondholding nature with Eastern bonding houses. The first bond issue was about $400,000, with an additional issue later of about $350,000. The company's plant is at Elwha Canyon, about 7 miles from Port Angeles. It has been offered to the city of Seattle at a price of $2,000,000, and purchase is now being considered.

Western Light & Power Company, Boulder, Col.—An issue of $2,100,000 of first mortgage 5 per cent sinking-fund ten-year gold bonds is being offered at 93.5 and interest to yield about 6 per cent. The bonds are secured by an absolute first mortgage on the entire property of the company, subject only to $128,000 divisional bonds covering the Cheyenne property alone. Besides a light and power system, the company operates a street railway and does a steam-heating business. Over 85 per cent of the company's gross business is derived from light and power.

United Light & Power Company of New Jersey.—The Bankers' Trust Company of New York, as trustee of the collateral trust 6 per cent gold notes of the company, will sell at public auction on Jan. 12 the collateral behind these notes. The action will be taken because of defaults on interest on the notes. The collateral consists of $2,023,000 first and general 6 per cent bonds of the United Light & Power Company of California, 300,000 shares of common stock and 150,000 preferred stock of this concern, par value $10 a share.

Utah Securities Corporation, New York, N. Y.—The aggregate earnings, both gross and net, of the operating properties controlled by the corporation were the largest for the month of November for any month in the history of the properties and likewise were the largest for the twelve months which ended Nov. 30, 1915, for any twelve-month period. The gross earnings for November amounted to $434,379, an increase of 15 per cent, and the net earnings were $239,236, an increase of 32 per cent. For the twelve months ended Nov. 30, 1915, the gross earnings were $4,758,983, an increase of 3 per cent, and the net earnings were $2,485,622, an increase of 10 per cent.

Manufacturing and Industrial

Wire and Cable Business Flourishing

The domestic wire and cable business, according to statements made to the ELECTRICAL WORLD, has entered upon a period of prosperity greater than has ever been experienced before. This situation seems to be general in all lines from telephone wire up to large power cable. When those concerned were asked regarding the conditions underlying the present situation, their answer was threefold. First, beginning with the panicky conditions in the money market created by the outbreak of hostilities in Europe, light and power companies retrenched and reserved any funds on hand for construction work to be employed for immediate uses that might crop up, in order to insure service. As a result extensions and improvements were allowed to lapse until money should become easier. That condition now being at hand, the lighting utilities find it possible to go ahead with extensions previously planned and now made necessary by the increasing amount of new business. Second, the large increase in the use of electricity in the manufacture of war munitions, evidenced in the enormous sale of motors to these industries, as reported in these columns last week, has made necessary many immediate extensions calling for large quantities of wire and cable. Third, there is to a certain degree a buying movement on the part of contractors and dealers in wire in anticipation of a further rise in the prices of raw materials.

The present flourishing condition of the wire and cable market, it is pointed out all along the line, is not a "flash in the pan." It is not permanent in the sense that it has reached its limit. In other words, it is felt everywhere that the demand for wire and cable will go far ahead of what it now is, and conditions are such that it is not at all improbable that the height to which the market will go will exceed the now somewhat conservative expectations of the wire manufacturers.

As to deliveries, the best that can be said is that manufacturers are holding their own. On small orders prompt delivery can be made, while on very large orders there is a certain small delay. This delay, however, is to a large extent due to the market in raw materials. Where steel is employed in the manufacture of cable, a delay of perhaps eight weeks is to be expected, owing to the steel trade being swamped with orders. There is little or no trouble getting copper, but the prices are such that it is not being purchased in large quantities, but generally only to supply the demand of orders in hand. Dependent as the trade is on imports for rubber, certain effects are felt in this direction. Manufacturers of differently colored braided wire have been hampered by the closing of the German dye market. Since the war the price of dyed cotton has been doubled, with deliveries uncertain.

Credits remain unchanged. Collections are uniformly better, although at no time during the business embarrassment of the previous year were they so poor as to be a source of worry. This is significant in view of the fact that so many orders are placed by small contractors and dealers. In this connection it is pointed out that future buying of wire supplies by contractors and dealers will undoubtedly be large because of the erection of new buildings. This activity, which is the last to reflect prosperity, has just begun to make itself felt.

Fairbanks, Morse & Company, 900 South Wabash Avenue, Chicago, Ill., maintained an exhibit at the Atlanta Electrical Show, Nov. 29-Dec. 4. The company showed its ball-bearing induction motor, which is equipped with an internal starter. The company also showed its fifty-light plant for country homes, which included its ball-bearing generator and its type Z oil engine.

Sale of Display Waterwheel and Turbine.—Benjamin B. Lawrence, a member of the Columbia University class of 1878, has purchased the Pelton-Doble waterwheel and the Pelton-Francis turbine, which the Pelton Water Wheel Company, San Francisco, Cal., exhibited at the Panama-Pacific International Exposition, and has presented the equipment to the Columbia School of Mines.

Motograph Signs Proving Popular in New York.—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill., has recently received orders for two new "motograph" signs to be installed in New York City. The large-sized sign already in place at Forty-second Street and Seventh Avenue is attracting considerable attention from the crowds of passers-by.

Orders for Electric Clock System.—The Betts & Betts Corporation, 256 West Fifty-fifth Street, New York, is installing a self-winding chime clock for the Corsicana National Bank, Corsicana, Tex. As already noted in the ELECTRICAL WORLD of Dec. 11, the company has also recently been awarded the contract for an extensive clock system for the Court of Appeals Building at Albany, N. Y.

Electric-Stove Newspaper Advertising.—A series of attractive advertisements for newspapers have been prepared by the Globe Stove & Range Company, Kokomo, Ind., for use by dealers and various central-station companies. Each advertisement contains a reproduction of one of the company's ranges, and the subject matter dwells on points of particular interest to the housewife. Recently the series of advertisements was used to good advantage by the Scranton (Pa.) Electric Company in its campaign to further the use of electricity for cooking. Other campaigns in which stoves made by the Globe company have been featured in newspaper advertising have been held in Burlington, Iowa, and Marion, Ind.

Traveling Commercial Exhibit to Be Made by Government.—The Bureau of Foreign and Domestic Commerce has issued a statement saying that it is intending to make a series of traveling exhibits which will be in charge of commercial experts. The exhibits are to be instituted in connection with the bureau's efforts to extend the foreign trade of the United States. Headquarters for a sample exhibit have been planned at the branch office of the bureau in New York, and several hundred samples have already been assembled. The sample exhibit will be so arranged and shown as to make clear to interested merchants and manufacturers the competitive conditions which must be met in introducing an article in a foreign market.

Pittsfield (Mass.) General Electric Works Active.—In a recent address at Pittsfield, Mass., Joseph Insull, plant manager of the local factories of the General Electric Company, said that the works have been greatly enlarged since their purchase in 1902, now having a total floor area of 1,600,000 sq. ft., or about 40 acres. In 1902 there were 1200 em-

ployees, compared with 4500 to-day. The plant has sufficient room for about 7500 employees and a possible monthly output of 400,000 hp. in transformers, 25,000 electric flatirons, 14,000 electric fans, 2000 small motors of 3-hp. average rating, 1000 electric ranges, and numerous other devices. Quoting Dr. Steinmetz, Mr. Insull said that when electricity becomes universally employed it will be against the law to have a fire of any kind inside the city limits. The speaker emphasized the present vigorous activity of the plant, and closed by saying that with the probability of obtaining fresh amounts of capital to develop the electrical industry it is believed that the latter will advance in ratio with the prosperity of the United States, and that Pittsfield will participate in the growth and benefits of the industry at large.

Electric Show a Boon for Dealer in Electric Laundry Machines.—Wallace B. Hart, 46 East Forty-first Street, New York, dealer in electric washers, driers and motor-driven ironing machines, finds that the New York Electric Shows help his business considerably. At each of the annual expositions he maintains a booth in a prominent location and employs a corps of demonstrators who are busy from the time the Grand Central Palace doors open in the morning until they close late at night. Several types of washers and ironers are kept in operation as long as the show is open. Mr. Hart believes in aggressive selling methods at shows of this type. "To get business," he declares, "you've got to be doing something every minute. If a woman comes to our booth and is doubtful about this or that point of any of our machines, we prove to her by actual demonstrations that she is wrong." Mr. Hart has established a permanent demonstrating room at the above-named address where he is prepared to show prospective purchasers how the machines can be employed to wash, dry and iron clothing or goods of any type or texture desired. Mr. Hart finds that many well-to-do families in New York are installing complete washing, drying and ironing outfits to solve the increasingly harassing servant problem.

Sixty Thousand Square Feet Added to Magneto Manufacturer's Plant.—The already extensive factory of the Bosch Magneto Company at Springfield, Mass., in which all Bosch magnetos sold in the United States have been manufactured since its complete occupation in 1912, has recently been enlarged, the addition providing more than 60,000 sq. ft. The greater facilities will enable the company to increase the production of magnetos in keeping with the demand, which has grown considerably during the past year. The building is a single-story structure with a frontage of about 175 ft. In addition to this building there are a connecting building and shipping hall, which also provide considerable new space. The roof of the building is arranged in saw-tooth form, providing the maximum of light and ventilation. The new factory will be filled with large automatic lathes and other machines of similar design, it being the intention of the company to segregate this type of work in a single section if possible. The shipping hall in itself is rather extensive, since it can accommodate five freight cars at one time; thus the shipping and receiving of the large quantities of heavy material can be done entirely within the building. A new side track has been laid to run from the Boston & Maine Railroad into the shipping hall, making two sidings running into the factory directly from the main line.

General Electric Company Buys Interest in Owen "Magnetic" Car and the Entz Patents.—The General Electric Company has acquired a substantial interest in the Owen "magnetic" car and the Entz patents covering the system of electric transmission employed in that car. Hereafter the electrical units employed in this transmission will be manufactured exclusively by the General Electric Company. This combination of interests was brought about after an exhaustive investigation and extended tests of the electric transmission used in the Owen cars, conducted under the direction of W. B. Potter, chief engineer of the railway department of the General Electric Company. That company has entered into an arrangement pursuant to which it will undertake the manufacture of the electric transmission units for the Owen cars and for other motor-car manufacturers who may become licensed to manufacture cars equipped with the electric transmission. The tests conducted by the General Electric Company involved not only exhaustive dynamometer tests but also road tests covering several thousand miles under the most severe touring conditions. Electric transmission is no new problem to the General Electric Company, as it has been incorporated in the suburban passenger cars equipped with gas-electric drive, of which a large number are in service, and also in many industrial electric locomotives. The Entz transmission, as improved and developed, eliminates the use of gears and adds, it is claimed, nothing to the ordinary car which is not already there in a slightly developed form. In the tests that were made particular stress was placed on what the car would do on steep grades in comparison with other standard high-grade cars, and it was proved conclusively, according to statements made by the manufacturers, that the Owen cars not only had many advantages over gear-driven cars, but could more than hold their own with them on the steepest grades. R. M. Owen will remain as the head of the Owen Magnetic organization, while E. S. Partridge will act as sales manager. A large production of Owen "magnetics" has been arranged for, and agencies for the car are now being placed in the larger cities.

Western Electric Developments in 1915.—Various types of new apparatus have been placed on the market in 1915 by the Western Electric Company, 463 West Street, New York. To meet the demand for intercommunicating telephone systems in apartment houses, the company has brought out what is called the No. 20 apartment-house "inter-phone" system, which is arranged for service between persons in vestibules and in apartments or janitors or tradespeople and apartment residents. The vestibule outfit consists of one vestibule "inter-phone" and any number of letter-box units. Telephone apparatus brought out in 1915 includes a flashing ring-off and recall signal for use with magneto switchboards to prevent "hang-up" troubles and increase operating efficiency; an all-metal switchboard for use on board ships; a new type of the familiar No. 1317 magneto telephone for rural service, which is designated as the No. 1317-C type; a loud-speaking telephone for railway train-dispatching work; a heavy-duty relay known as the E-type relay designed for use where a large number of contacts must be operated at the same time; a universal type of telephone switchboard key for use with the universal type of key shelf; a group protector designed for group mounting; a hand-telephone set designated as the No. 1004 type which has been developed in collaboration with the United States Forest Service for use in forest-patrol work; a police signal lamp which is operated by closing a local circuit through an alternating-current relay installed in a telephone set on a lamp-post; a water-tight hand-set telephone with ringer box for use on naval vessels, and a loud-ringing extension bell, known as the No. 392 type, for use on telephone lines in noisy factories and on farms or other outdoor places. Among the household appliances placed on the market by the Western Electric Company are the following: an electrically operated dish-washer, a miniature cook-stove known as the "Junior" electric range, a toy transformer, an electric lantern operated by dry battery and a portable floor lamp. The company has also brought out a portable electric drill and electric hammer.

NEW YORK METAL MARKET PRICES

	Dec. 7 Selling Prices Bid	Dec. 7 Selling Prices Asked	Dec. 14 Selling Prices Bid	Dec. 14 Selling Prices Asked
	£ s d		£ s d	
London, standard spot	77 5 0		76 12 6	
Prime Lake	19.37½	to 19.62½	19.25	to 19.50
Electrolytic	19.37½	to 19.62½	19.25	to 19.50
Casting	18.87½	to 19.12½	18.87½	to 19.12½
Copper wire base	19.75	to 20.00†	20.75	to 21.00
Lead	5.25		5.40	
Nickel	45.00	to 50.00	....	to ....
Sheet zinc, f.o.b. smelter	22.00†		22.00	
Tin, Straits	37.37½†		37.75†	
Aluminum, 98 to 99 per cent.	56.00	to 58.00	56.00	to 58.00

OLD METALS

Heavy copper and wire	16.00	to 16.25†	15.00	to 16.00†
Brass, heavy	10.75	to 11.00†	10.50	to 10.75†
Brass, light	9.00	to 9.25†	8.50	to 9.00†
Lead, heavy	4.50	to 4.62½†	4.40	to 4.60†
Zinc, scrap	11.00	to 11.50†	10.00	to 10.50†

*COPPER EXPORTS

Total tons to Dec. 14 19,601

†Nominal.

New Incorporations

The Wanatah Electric Company, Wanatah, Ind., has been incorporated with a capital stock of $5,000 by Harry H. Keller, Alfred H. Kimble and others. The company is building an electric plant in Wanatah.

The Krick Electric Company, Sinking Spring, Pa., has been granted a charter with a capital stock of $5,000. The company purposes to supply electricity to that portion of Spring Township outside of Sinking Spring. W. F. Krick is treasurer.

New Industrial Companies

The International Electric Products Corporation, New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The incorporators are W. Dublier and M. E. McLean, 50 Church Street, New York, N. Y.

The Weil-Strauss Corporation, New York, N. Y., has been incorporated by H. H. A. Meyn, M. Weil and A. A. Strauss, 50 Church Street, New York, N. Y. The company is capitalized at $10,000 and purposes to do a general mechanical, electrical engineering and contracting business.

The Electric Panelboard Company, Rochester, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in electric switchboards, appliances and electrical devices, etc. The incorporators are C. J. MacDonald, W. J. Pierce, and J. B. Tucker, 79 Pinnacle Road, Rochester.

The K. & W. Engineering Company, St. Paul, Minn., has been incorporated with a capital stock of $75,000 for the purpose of manufacturing and dealing in equipment for electric lighting and power plants, electrical devices, and other articles pertaining to the electrical, mechanical, hydraulic, refrigerating and engineering industries. The officers are: James W. Kellogg, president; Raymond E. White, vice-president and treasurer, and Grover C. Laing, Minneapolis, secretary.

Trade Publications

Pumping Outfit.—The Columbiana Pump Company, Columbiana, Ohio, has published an illustrated bulletin on its electrically operated pumping outfits.

Electric Radiator.—The Rathbone Manufacturing Company, Grand Rapids, Mich., has issued an illustrated booklet on its electrically operated radiator.

Attachment Plugs.—R. S. Mueller, 423 High Avenue, Cleveland, Ohio, is sending out a leaflet containing information on a non-swivel attachment plug.

Motor Speeds and Ratings.—The Mechanical Appliance Company, Milwaukee, Wis., has issued a booklet entitled "Motor Speeds and Ratings for All Power Circuits."

High-Voltage Horn-Gap Switches.—The Railway & Industrial Engineering Company, Pittsburgh, Pa., is sending out an illustrated folder on its Burke high-voltage horn-gap switches.

Electric Air Heater and Blower.—A portable combined air heater and blower is described and illustrated in Bulletin 219 issued by the B. F. Sturtevant Company, Hyde Park, Boston, Mass.

Electric Grinder.—The Stow Manufacturing Company, Binghamton, N. Y., is sending out illustrated Bulletin No. 33, on its electric flexible-shaft grinder designed especially for the steel industry.

Vacuum-Cleaning Machines for Factory Use.—Hanlon & Wilson, 321 Penwood Avenue, Wilkinsburg, Pa., have issued an illustrated folder on their motor-driven type No. 1 and type No. 2 factory cleaners.

Disconnecting Switches.—The Royal Electric Manufacturing Company, 556 East Fortieth Street, Chicago, has issued an illustrated folder which contains information on its outdoor disconnecting switches.

Bell-Ringing Transformer.—The Viking Electric Company, 150 Chambers Street, New York, has prepared an illustrated folder on its recently developed type E-W, type A and type B bell transformers.

Small Motors.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending out an illustrated folder which contains information on several of its types of small electric motors.

Washing Machines.—The Wash-Easy Company, Fourteenth Street & Western Avenue, Chicago, Ill., has issued an illustrated folder descriptive of its revolving-cylinder electrically operated washing machines.

Battery Chargers and Magnetizers.—The St. Louis Electrical Works, Arlington and Easton Avenues, St. Louis, Mo., have published a booklet descriptive of several types of their battery-charging apparatus and magnetizers.

Electric Hand Lantern.—"The Little Wonder Electric Lantern" is the title of an illustrated folder which contains information on a small battery-operated lantern issued by the Hartford Electric Company, Chicago, Ill.

Household Appliances.—The Alter Light Company, 827 South Loomis Street, Chicago, Ill., is sending out an illustrated folder descriptive of a number of lighting fixtures, electric irons, electric toaster and other household devices.

Alternating-Current Generators.—Bulletin No. 1075-A issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., contains illustrations of and information on type AB and type AH belted alternating-current generators.

Ornamental Lighting Fixtures.—The Beardslee Chandelier Manufacturing Company, Chicago, Ill., has issued Leaflets K-5-1 to K-5-6, inclusive, which contain sketches of various types of its chandeliers and other ornamental lighting fixtures.

Transmission-Line Clamp.—Hickey & Schneider, 61 Broadway, New York, have issued an illustrated bulletin descriptive of the Johnson transmission-line clamp, which is designed for use in making live connections without interrupting service.

Store Lighting.—The Westinghouse Lamp Company, 1251 Broadway, New York, has just issued an illustrated booklet entitled "A Simple but Important Problem," which deals with the lighting of store interiors, display windows, showcases and electric signs.

Push-Button Switches and Receptacles.—The Hart Manufacturing Company, Hartford, Conn., has prepared an attractively illustrated brochure on its "Diamond H" push-button switches and receptacles. The publication has been prepared especially for architects.

Lighting Fixtures.—The Faries Manufacturing Company, Decatur, Ill., has issued a number of illustrated folders, some of which are printed in colors, descriptive of its "Verdelite" desk and piano lamps, floor lamps, bedpost lamps and various types of adjustable fixtures.

Toggle Switch.—The Newton Manufacturing Company, Lynbrook, N. Y., is sending out an illustrated leaflet on its new toggle switch, which is adapted for use in private houses, apartments and other buildings where interior detail has been carefully planned and considered.

Armored Conductors.—The Western Conduit Company, Youngstown, Ohio, has issued a booklet descriptive of its "Realflex" armored conductor for wiring either new or old buildings. The booklet contains a number of illustrations showing methods of installing the conductors.

Boiler-Room Economy.—"Establishing and Maintaining Boiler-Room Economy" is the title of a paper read before the Ohio Society of Mechanical, Electrical and Steam Engineers by G. H. Gibson, reprints of which have been issued by the Harrison Safety Boiler Works, Philadelphia, Pa.

Steam Turbines.—"The Terry Turbine" is the title of Bulletin No. 20, just issued by the Terry Steam Turbine Company, Hartford, Conn., and containing a general description of turbine applications. It deals particularly with several kinds of high-pressure, low-pressure and mixed-pressure turbines.

Peak-Reading Voltmeter and Apparatus for Measuring Low Resistance and Conductivity.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued Bulletin No. 710, entitled "Simplex Wire & Cable Company's Peak-Reading Voltmeter," and Catalog No. 40, on apparatus for measuring low resistance and conductivity and on the Hoopes conductivity bridge.

New England

PORTLAND, ME.—The City Council is considering the extension of the ornamental lighting system on several streets.

PORTSMOUTH, N. H.—Under the new five-year contract entered into between the City Council and the Rockingham County Lt. & Pwr. Co., provision is made for the installation of three-lamp clusters on Congress Street from Bridge to Daniel Street; on Pleasant Street from State Street to Market Square, and on Market Street from Market Square to Bow Street.

SUNAPEE, N. H.—The Board of Trade of Sunapee has adopted a resolution recommending the purchase of the power plant at George's Mills. It is proposed to enlarge the plant to supply electricity for a street-lighting system, using the town water system for power as at present.

BRANDON, VT.—The Public Service Commission has granted the Hortonia Pwr. Co., Brandon, permission to issue $500,000 in bonds, the proceeds to be used for the development of the Silver Lake water-power project.

HARDWICK, VT.—The village of Hardwick has decided to extend the municipal electric service to the villages of East Hardwick, Greensboro, Greensboro Bend and Craftsbury. The cost of the extensions, including transformers, meters, etc., is estimated at $11,626.

HULL, MASS.—The committee appointed to investigate the advisability of selling the municipal electric-light plant to the Weymouth (Mass.) Lt. & Pwr. Co. has reported against the sale. It recommends the proposal to purchase energy from the Weymouth company and distribute it over the municipal system. A special town meeting will soon be called to vote on the proposition.

NEWBURYPORT, MASS. — Options on the Fiberloid property on Water Street, on the Merrimac River, have been obtained by the Newburyport (Mass), Gas & El. Co., on which it proposes to erect a plant, to cost approximately $200,000.

WORCESTER, MASS.—The Worcester El. Lt. Co. has awarded the contract for alterations to its plant on Faraday Street to the E. J. Cross Co. The cost of the work is estimated at $10,000.

Middle Atlantic

BATAVIA, N. Y.—The city of Batavia has engaged Chester & Fleming, hydraulic and sanitary engineers, Union Bank Building, Pittsburgh, Pa., to prepare plans for rebuilding the electric-lighting plant, waterworks, sewerage system, etc., for which bonds to the amount of $175,000 were recently voted.

BINGHAMTON, N. Y.—The Board of Education has engaged Clarence E. Beach to prepare plans and specifications for installing electric lamps in the Oak and Pine Street schools. An appropriation of $1,600 has been made for the work.

COBLESKILL, N. Y.—The Public Service Commission has approved extension of the transmission lines of the Courter El. Co. through the town of Cobleskill, under the franchise recently granted by the town authorities. Additional energy will be secured for the new lines through arrangement with the Mohawk Hydro-Electric Co. The Courter company is authorized to erect a high-tension transmission line from Fort Plain to Cobleskill, passing through the towns of Minden and Canajoharie, Sharon and Cobleskill. Franchises have been secured from all the towns through which the line will pass.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

DUNDEE, N. Y.—E. L. Bailey, owner of the local electric-light plant, has closed a contract with the Starkey Seminary, 3 miles distant, to supply that institution with electricity for a period of five years. Electrical service will also be supplied to a number of residents of that town.

EAST AURORA, N. Y.—The Public Service Commission has approved the exercise of franchises for electrical distribution systems in the towns of Wales and East Aurora by the East Aurora El. Lt. Co.

FREDONIA, N. Y.—The Niagara & Lake Erie Pwr. Co., Fredonia, has again applied to the Public Service Commission for permission to establish an electric plant in Portland, Chautauqua County.

LANCASTER, N. Y.—The Depew & Lancaster Lt., Pwr. & Conduit Co. has petitioned the Public Service Commission for permission to issue $22,200 in bonds.

NEW BRIGHTON, N. Y.—The Richmond Lt. & R. R. Co., New Brighton, has petitioned the Public Service Commission for permission to make improvements and additions to its electric plant.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, corner of Centre and Walker Streets, New York, until Dec. 23, for furnishing three automobile trucks and two automobile ambulances. Blank forms and further information may be obtained at the office of the chief clerk of the Department of Health, Centre and Walker Streets.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2342, Municipal Building, New York, until Dec. 21, for furnishing incandescent electric lamps, to be delivered on or before Dec. 31, 1916. Blank forms of bid, proposals and contract, including specifications, may be obtained at Room 2324, Municipal Building.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, corner Centre and Walker Streets, New York, until Dec. 21, for furnishing and installing electric circuit work, fixtures, etc., on the sixth floor of the Department Building at 139 Centre Street. Plans may be seen and blank forms obtained at the office of the chief clerk of the department, corner of Centre and Walker Streets.

NEW YORK, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Room 2342, Municipal Building, New York, until Dec. 22 for furnishing cast-iron lamp-posts, exclusive of steel shafts. Bidders are requested to make their bids or estimates upon blank forms prepared by the department, copies of which may be obtained upon application at the office of the department, Room 2324, Municipal Building, where plans and specifications may be obtained.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2342, Municipal Building, New York, until Dec. 27 for furnishing electricity to the borough of Queens as follows: (1) For furnishing and maintaining electric-lighting units for lighting public streets, parks and places from Jan. 1, 1916, to Dec. 31, 1916, both inclusive; (2) for furnishing electric current for light and power in public buildings and for furnishing and maintaining certain equipment during said period; (3) for performing sundry repair and other work to lighting equipment furnished by the city during said period. Blank form of bids, proposal and contract, including specifications, can be obtained at Room 2324, Municipal Building.

NEW YORK, N. Y.—Bids will be received by the board of trustees of Bellevue and Allied Hospitals, 415 East Twenty-sixth Street, New York, until Dec. 27 for the completion of the abandoned contract of the International Gas & El. Fixture Co. for furnishing and installing all the lighting fixtures in pavilions "I" and "K" of the new Bellevue Hospital, situated Twenty-sixth to Twenty-ninth Street, First Avenue to East River, borough of Manhattan. Blank forms and further information may be obtained at the office of the contract clerk and auditor, 400 East Twenty-ninth Street, New York.

ALLENTOWN, PA.—The Bonney Vise & Tool Co. is contemplating the erection of a large addition to its plant in Allentown. All machinery will be electrically driven. J. Edward Durham, Jr., is vice-president and treasurer.

COATESVILLE, PA.—A permit has been granted to Worth Brothers Co., Coatesville, for the construction of a power house 43 ft. by 100 ft., one story high.

ELLWOOD CITY, PA.—The plant and holdings of the Pennsylvania Pwr. Co., Ellwood City, have been purchased by the Mahoning & Shenango Ry. & Lt. Co., Youngstown, Ohio. Plans are being prepared by the new owners for extensive improvements, including the construction of a new dam. The cost of the proposed work is estimated at about $150,000.

GREENCASTLE, PA.—The Greencastle Lt., Ht., Fuel & Pwr. Co. is erecting a large transformer station on land of the Chambersburg, Greencastle & Waynesboro St. Ry. Co. in Greencastle and is preparing to furnish a 24-hour service to local consumers.

LANCASTER, PA.—Plans have been approved by the City Council for improvements to the municipal water-works system, providing for the installation of two electrically driven centrifugal pumps, to cost about $60,000. Electricity to operate the pumps will be obtained from the Edison El. Co., Lancaster.

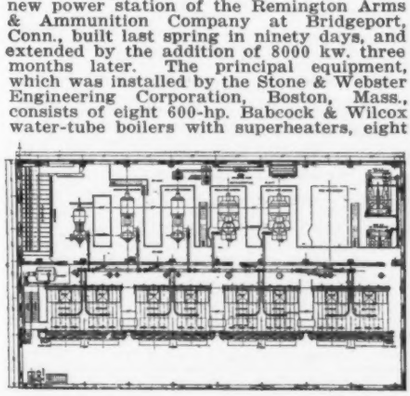
LANCASTER, PA.—The merger of four electric companies in Berks County under the name of the Berkshire El. Co., with a capital stock of $55,000, has been approved by the Governor of Pennsylvania. The companies included in the consolidation are the Sinking Spring El. Co., capitalized at $40,000; the Cumru Township, Heidelberg and Wernersville electric companies, each capitalized at $5,000. The office of the company will be in Lancaster.

MONROETON, PA.—Steps have been taken toward organizing a company in Monroeton for the installation of an electric-light plant. It is proposed to obtain energy from the plant of the Towanda El. Illg. Co., 4 miles distant. The company is to erect the transmission line from Towanda to Monroeton.

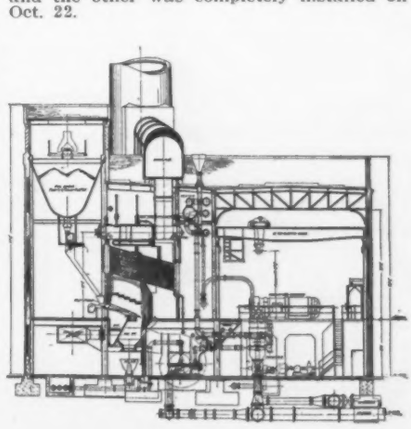
PHILADELPHIA, PA.—The construction of a large electric-power plant in the northeastern section of the city is reported

Rapid Construction and Extension of Power Station for Remington Arms & Ammunition Company

The accompanying sketches show the main-floor plan and a cross-section of the new power station of the Remington Arms & Ammunition Company at Bridgeport, Conn., built last spring in ninety days, and extended by the addition of 8000 kw. three months later. The principal equipment, which was installed by the Stone & Webster Engineering Corporation, Boston, Mass., consists of eight 600-hp. Babcock & Wilcox water-tube boilers with superheaters, eight



seven-retort stokers with forced-draft fan equipment, three 300-gal. turbine-driven feed pumps, three 500-gal. low-service pumps, one 750-kw., two 2000-kw. and two 4000-kw. General Electric turbo-generators, three 65-kw. combination exciter sets, one 750-kw., two 2000-kw. and two 4000-kw. condenser equipments, intake and discharge pipe lines and cooling system, two 2500-gal. service heaters, two 2500-gal. turbine-driven pumps with thermostatic control, one 25-ton, three-motor electric traveling crane, two 1500-cu. ft. steam-driven air compressors, two 1000-gal. turbine-driven fire pumps, track hoppers, feeder crusher, elevator conveyor and tripper, motors, scales, locomotive crane, etc., refrigerating plant, underground work, substation equipment, etc. The original contract provided for an equipment rated at 4750 kw. Authorization to proceed with the purchase and installation of the equipment was given on March 3, 1915, and unit No. 1 carried a commercial load on June 1. Units Nos. 2 and 3 were ready for operation on June 20. Early in June it was decided to increase the rating of the station to 12,750 kw. by the addition of two 4000-kw. units. The first of these units was ready for operation on Oct. 1, and the other was completely installed on Oct. 22.



to be under consideration by the Philadelphia El. Co.

RIDGWAY, PA.—The Ridgway El. Lt. Co. will award contract for construction of a new power house about Dec. 20. Contracts for equipment, consisting of two 2000-kw. General Electric turbo-generating units, boilers, stokers, condensers, etc., have been placed. H. T. Hartman, Land Title Building, Philadelphia, Pa., is engineer in charge. J. George Kaelber is president.

TARENTUM, PA.—The City Council is considering the purchase of new equipment for the municipal electric-light plant. The city has recently entered into a contract with the borough of Tarentum to supply energy to maintain the municipal system in that borough.

WILLIAMSPORT, PA.—The Public Service Commission has approved the contract between the city of Williamsport and the Lycoming-Edison El. Co. for lighting the streets of the city.

LAMBERTVILLE, N. J.—The City Council has decided to award the contract for street lighting to the Lambertville Pub. Ser. Co. Under the new contract, which is for a period of three years, the company agrees to install new street lamps, and recommends the use of nitrogen-filled lamps, of which forty-four would be of 400 cp. each, forty-eight of 250 cp. and twenty-two of 80 cp.

CHESTERTOWN, MD.—The Public Service Commission has granted the Chestertown El. Lt. & Pwr. Co. permission to issue $22,000 in bonds. Of the proceeds about $15,000 will be used to retire a previous issue and the remainder for the purchase of additional equipment for the plant.

WELLSBURG, W. VA.—The contract for the construction of buildings for the large electric power plant in Wellsburg for the American Gas & El. Co., 30 Church Street, New York, has been awarded to the Foundation Co., 233 Broadway, New York. The initial installation will have an output of 60,000 hp., with provision for an ultimate development of 200,000 kw. The company has contracted with the Richmond Coal Co., Wheeling, for the entire coal supply for 45 years from the Beach Bottom mine, near Wellsburg. A double-circuit heavy-steel line will at once be erected to Canton and operated at 140,000 volts. Connection will also be made with the company's present system at Wheeling and Newark. The General Electric Co. will furnish the turbines and the Babcock & Wilcox Co. the boilers. The cost of the initial development is estimated at $2,500,000. Sargent & Lundy, consulting engineers, 1270 Railway Exchange Building, Chicago, Ill., are in charge of the work.

WHEELING, W. VA.—The Wheeling El. Co., it is reported, is contemplating the construction of an electric-power plant at Tiltonville. J. B. Garden is general manager.

WHEELING, W. VA.—Bids will be received at the United States engineer's office, Wheeling, W. Va., until Jan. 6, 1916, for building a fireproof power house at dam No. 14 on the Ohio River.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Brooklyn, N. Y., Schedule 9100—230 lenses for deck lights; Schedule 9097—four panels for local turret fire control; Schedule 9102—3000 ft. four-conductor telephone cable, 20,000 ft. double-conductor wire, 1500 ft. single-conductor wire, 3600 ft. twin-conductor-wire; Schedule 9101—10-gage testing outfits. Washington, D. C., Schedule 9093—miscellaneous electrical supplies; Schedule 9084—one power pipe-threading and cutting-off machine. Philadelphia, Pa., Schedule 9086—two controllers for boat cranes. Applications for proposals should designate the schedule desired by number.

North Central

LAPEER, MICH.—The City Council has awarded a contract for lighting the streets of the city. The new contract provides for the installation of an ornamental lighting system on Nepessing Street.

PAW PAW, MICH.—The town of Paw Paw is contemplating replacing the arc lamps in the business district with cluster lamps.

COLUMBUS, OHIO.—Harry E. Eichborn, superintendent of the municipal electric-light plant, has authorized the installation of the new-type nitrogen lamps to replace the arc lamps as fast as they wear out. There are nearly 2800 arc lamps in use in the city.

HAMILTON, OHIO.—The Council has instructed the Park Board to prepare plans and estimates of cost of the installation of a complete cluster-lamp lighting system in the parks. James O'Toole, superintendent of the municipal plant, estimates the cost at $3,200.

OTTAWA, OHIO.—The Public Utilities Commission has granted the Northwestern Ohio Lt. Co., Van Wert, permission to purchase the plant and holdings of the El. Lt. Co. of Ottawa.

OVERPECK, OHIO.—Steps have been taken by the Overpeck Improvement and Protective Association for the installation of a street-lighting system here. Energy to maintain the system will be obtained from the Hamilton Utilities Co., Hamilton. John P. Reif is secretary of association.

WARREN, OHIO.—The Trumbull Steel Co. has contracted with the Trumbull Pub. Ser. Co., Warren, for electrical service to drive seven hot rolls in its new sheet mill and all machinery in two new jobbing mills which are being erected in Warren. The main mill motor, which is rated at 2250 hp., 2200 volts, has been purchased from the Westinghouse El. & Mfg. Co., Pittsburgh.

CARLISLE, KY.—The capital stock of the Carlisle El. & Pwr. Co. has been increased from $15,000 to $30,000. The company contemplates building an ice factory.

CLAY, KY.—The Clay Lt. & Ice Co. has applied to the Town Board for a franchise to supply electricity in Dixon.

HAZARD, KY.—Surveys and preliminary work relative to the construction of an electric plant in Hazard have been completed by the Kentucky River Pwr. Co. The initial installation will consist of a 2000-hp. steam turbine with 500-hp. boilers, equipped with automatic stokers. Space will be provided for additional equipment when required. Work on construction of plant, it is understood, will begin next spring. The cost of the plant is estimated at $300,000.

NEWPORT, KY.—The City Council has instructed Otto Wolff, city solicitor, to prepare an ordinance providing for the sale of an electric-light franchise. The old franchise expired several years ago and the city has secured its electrical service under a yearly contract since that time. The new ordinance will provide for an ornamental lighting system on several streets.

INDIANAPOLIS, IND.—The Board of Public Works has decided to erect ornamental lamp standards on Maryland Street, between Capitol Avenue and Delaware Street, at a cost of about $5,000.

OSCEOLA, IND.—The Public Service Commission has approved a contract between the Indiana & Michigan El. Co., South Bend, and the town of Osceola for furnishing electricity in that town.

JACKSONVILLE, ILL.—Property owners on South Main Street from Morton to Michigan Avenue are considering the question of installing ornamental lamps on that thoroughfare.

LORAINE, ILL.—Application has been made to the Public Utilities Commission of Illinois by Bert Van Blair for a certificate of convenience and necessity to operate an electric-lighting system in Loraine.

MACOMB, ILL.—The installation of a municipal electric-light plant in Macomb is under consideration.

OLNEY, ILL.—The installation of an electric-lighting system in Olney is under consideration by the Council.

TAMMS, ILL.—The Tamms Ice, Lt. & Fuel Co., recently incorporated, proposes to generate electricity and establish an ice factory in Tamms. E. J. Hodges, Sr., and E. J. Hodges, Jr., are interested in the project.

MERRILL, WIS.—Preparations are being made by the Merrill Ry. & Ltg. Co. for the erection of a high-tension transmission line from Merrill to Wausau. The plans provide for the development of the Trappe Rapids water-power, owned by the Wausau Street Ry. Co.

MILWAUKEE, WIS.—The County Board committee has decided to recommend the erection of 45 concrete electric-lamp standards on the Watertown Road.

MILWAUKEE, WIS.—Bids for supplying energy for maintaining the experimental street-lighting circuit on Grand Avenue, from Seventh Street to Sixteenth Street, will soon be asked by the city of Milwaukee.

MONTICELLO, WIS.—Bonds to the amount of $12,000 have been authorized for improvements to the municipal electric-lighting plant.

OMRO, WIS.—The Omro El. Lt. Co., it is reported, is installing an oil-engine-driven generating unit.

PRENTICE, WIS.—The Village Board has granted a franchise to D. U. Parkinson, Ashland, and J. E. Feely, Fifield, to install and operate an electric-lighting plant in Prentice. The local electric plant, it is understood, will be taken over and remodeled.

PRESCOTT, WIS.—The capital stock of the River Falls Pwr. Co., Prescott, has been increased from $75,000 to $100,000.

APPLETON, MINN.—The city of Appleton expects to install an additional 250-hp. boiler in the municipal electric-light plant and establish a steam-heating system next summer.

BEMIDJI, MINN.—The City Council has decided to replace the arc lamps now in use with nitrogen-filled lamps.

CARVER, MINN.—A franchise has been granted to the Minneapolis General Electric Co., Minneapolis, to install and operate an electric-lighting system in Carver for a period of twenty years.

GRANITE FALLS, MINN.—The Municipal Electric Light and Water Works Department expects to install an additional hydroelectric generating unit next year.

LITCHFIELD, MINN.—The Municipal Electric Light Department expects to install an additional 250-kw. generating unit in the municipal electric-light plant next summer.

MONTEVIDEO, MINN.—The Minnesota Valley Pwr. Co. is planning to install a new hydroelectric generating unit in the spring.

PLUMMER, MINN.—At an election held recently the proposal to issue bonds for the installation of an electric-light plant in Plummer was carried.

ROCHESTER, MINN.—The Commercial Club, it is reported, is considering the purchase for the city of the holdings of the Zumbro Pwr. Co. at Zumbro Falls, and to develop the power to generate electricity for transmission to Rochester and neighboring towns. It is proposed to establish a hydroelectric power plant and to expend the following sums for development: For rock and earth excavation, $5,000; construction of dam, $74,500; power house, $20,000; hydraulic and electric machinery, $35,000; cofferdams, temporary construction and equipment shrinkage, $10,500; transmission lines to Rochester, $24,000; site, flowage and lands, etc., $110,000.

SPRINGFIELD, MINN.—The Municipal Electric Light and Water Works Department expects to install an additional 175-hp. boiler in the spring.

WINSTED, MINN.—A franchise has been granted to the N. W. Lt. & Pwr. Co. to furnish electricity in Winsted.

MAQUOKETA, IOWA.—The Maquoketa Lt. & Pwr. Co. has applied for a new franchise. As the present franchise will expire in seven years, the company seeks a new one before making improvements to its system.

OSKALOOSA, IOWA.—The installation of an electrolier lighting system on South Market Street is under consideration.

BRANSON, MO.—Preparations are being made by the Branson Lt. & Pwr. Co., it is reported, for the installation of an electric-light plant in Branson and the erection of a transmission line to Hollister, 2 miles distant. The initial installation will have a generating capacity of 100 kva.

COWGILL, MO.—The local electric-light plant has been purchased by F. A. Smith. The deal also included the garage and theater owned by O. C. Switzer.

KANSAS CITY, MO.—Bids will be received by J. P. Langan, purchasing agent, City Hall, Kansas City, until Jan. 12, 1916, for designing, constructing and installing a steam turbine, reduction gear and centrifugal pumping unit of 20,000,000 U. S. gal. of water per 24 hours against a total combined head of 360 ft. and a steam pressure of 165 lb. per square inch at throttle, together with all machinery, tools and appurtenances necessary, in accordance with plans and specifications on file in the office of the chief engineer of the water department. Burton Lowther is chief engineer.

EPPING, N. D.—Local business men have organized a company, it is reported, for the purpose of establishing and operating an electric-lighting plant in Epping.

FORMAN, N. D.—The Otter Tail Pwr. Co., Fergus Falls, Minn., it is reported, contemplates the purchase of the plant of the Forman El. Lt. & Pwr. Co. The company is also contemplating the installation of plants at Cayuga, Rutland and Havana.

DALLAS, S. D.—Bonds to the amount of $4,000 have been voted for the purchase of the plant and holdings of the Dallas Lt., Ht. & Pwr. Co.

DELL RAPIDS, S. D.—The property of the Dell Rapids Lt. & Pwr. Co. has been acquired by the Consumers' Pwr. Co., Sioux Falls, which is now operating it as part of the Sioux Falls division. A transmission line (9 miles long) is being erected from Sioux Falls to Baltic, the location of the hydroelectric plant and small reserve plant, which is connected with the town of Dell Rapids by a five-mile transmission line.

Upon completion of the transmission line the station at Baltic will be dismantled and all power supplied from the Sioux Falls station.

BELLWOOD, NEB.—The local electric-light plant, owned by the Curtis Co., was recently destroyed by fire, causing a loss of about $10,000.

CONCORD, NEB.—Bonds to the amount of $2,500 have been issued for the installation of a municipal electric-lighting plant. Energy to operate the system will be obtained from the Laurel plant.

PITTSBURG, KAN.—Plans are being prepared by Crowell & Van Meter, architects, Caldwell-Murdock Building, Wichita, Kan., for the construction of a 70-ft. by 150-ft. three-story building for the Mount Carmel Hospital. The plans provide for vacuum steam-heating, electric wiring, complete refrigerating apparatus, electric elevator, vacuum cleaners, temperature regulators, etc.

SHARON SPRINGS, KAN.—Bonds to the amount of $10,000 have been authorized for the installation of an electric-lighting system in Sharon Springs.

TOWANDA, KAN.—The local electric-light plant has been purchased by the Kansas Gas & El. Co., Wichita. The new owners, it is stated, will make improvements to the system as soon as a new franchise is granted.

Southern States

BELMONT, N. C.—The Climax Spinning Co., Belmont, has awarded contract for construction of a one-story (531-ft. by 127-ft.) factory to R. C. Biberstein, Charlotte, to cost about $60,000. Cottages for operatives, to cost about $40,000, will also be erected. The mill will be operated by electricity, which will be obtained from the transmission system of the Southern Pwr. Co., Charlotte.

LAKE WORTH, FLA.—The City Council is contemplating an issue of $15,000 in bonds for the installation of an electric-light plant.

CHATTANOOGA, TENN.—Plans have been approved, it is reported, by the Tennessee River Pwr. Co., Chattanooga, for the development of the water-power of Caney Fork River, near Rock Island. The proposed work will include the construction of a concrete dam, forming a reservoir from which water will be conducted by tunnel through the mountain to a power house below the falls. The initial installation will have a generating capacity of 10,000 hp. The ultimate output of the plant will be 40,000 hp.

KNOXVILLE, TENN.—Bids will be received by the city of Knoxville, Tenn., until Dec. 31 for furnishing the city with not less than 600 arc lamps and lighting the city buildings. Further information may be secured upon application to John E. McMillan, Mayor, or John W. Flenniken, commissioner of streets.

GEORGIANA, ALA.—The McGowan-Bennett Milling Co., Georgiana, it is reported, is contemplating the installation of an electric plant in its feed mill to develop about 100 hp. The cost of the proposed plant is estimated at about $10,000. Bids for construction will be asked about April 1. W. M. McGowan is president.

FOREST, MISS.—The local electric-light plant, owned by R. J. Knoblock, is reported to have been purchased by the Bienville Lumber Co., which will be operated in connection with the lumber mill. All equipment, it is understood, has been purchased.

HARTFORD, ARK.—The installation of a municipal electric-lighting plant in Hartford is under consideration.

CROWLEY, LA.—The City Council is contemplating issuing bonds to the amount of $35,000 for improvements to the municipal electric-light plant and water-works system.

NEW ORLEANS, LA.—Bids will be received by the Board of Commissioners of the port of New Orleans, Suite 200, Court Building, New Orleans, until Dec. 29, for equipment for the public grain elevator in New Orleans, separate bids to be submitted as follows: For approximately 15,000 lin. ft. of elevator and conveyor belting from 22 in. to 40 in. wide of 5, 6 and 7 ply; for furnishing and installing an electrically operated freight elevator of 2000 lb. capacity; for furnishing f.o.b. New Orleans forty-eight three-phase, 60-cycle, 440-volt alternating-current motors from 3 hp. to 150 hp. and also sliding bases and starting compensators as may be required; for furnishing and erecting seven grain hopper scales of the trussed-lever type of 2000 bushels capacity; for furnishing f.o.b. New Orleans one elevator separator of 1200 to 3500 bushels per hour capacity, and one oat clipper of 1500 bushels per hour capacity. Plans and specifications are on file at the office of Ford, Bacon & Davis, engineers, 921 Canal Street, New Orleans. Copies of plans and specifications may be obtained from the engineers upon deposit of $10.

WASHINGTON, LA.—The installation of a municipal electric-light plant in Washington is under consideration.

CHANDLER, OKLA.—G. D. Henderson, Hopkins, Mo., has purchased an interest in the Chandler El. Co. and will take charge Jan. 1. The company will be in the market for a 100-hp. gas engine.

LAHOMA, OKLA.—Bonds to the amount of $6,000 have been issued for the installation of a municipal electric-lighting plant.

WELCHES, OKLA.—Bonds to the amount of $8,000 have been voted for the installation of an electric-lighting plant in Welches.

HOUSTON, TEX.—The properties of the Brunner Wtr. & Lt. Co., Houston, have been sold by A. J. Binz, receiver, to W. H. Ostenberg, for $14,900. The property consists of an electric-light plant and a water-works system, both of which are situated in Brunner.

Pacific States

METALINE FALLS, WASH.—The State Board of Land Commissioners has granted Hugh L. Cooper, consulting engineer, 101 Park Avenue, New York, N. Y., water rights on both sides of the Pend Oreille River for a distance of about 7 miles from McInnis Mills to 1 mile north of Blue Slide. It is proposed to build a large hydroelectric power plant in connection with the development of the nitrate fields in that district and the manufacture of various chemical materials.

POULSBO, WASH.—The Poulsbo Lt. & Pwr. Co. is erecting an electric-lighting system in Poulsbo. Energy for operating the plant will be secured from the Olympic Pwr. Co., Port Angeles. W. H. Ballentine, Poulsbo, is engineer in charge.

PROSSER, WASH.—The City Council is considering calling an election to submit the proposal to issue bonds for the construction of a municipal electric-light plant. It is proposed to develop a water power site on the Yakima River, a few miles east of Prosser. Electrical service is now supplied by the Pacific Pwr. & Lt. Co.

SEATTLE, WASH.—If plans for the purchase of an additional power plant by the city of Seattle are agreed upon a bond issue of about $3,000,000 will be submitted to the voters at the general election to be held on March 7, 1916.

DALLAS, ORE.—The Oregon Pwr. Co. is contemplating extending its transmission lines to supply electrical service in Rickreall and contiguous territory. A. L. Martin is local manager.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Corpn., Fresno, is contemplating several extensions to its service. Work will begin in the near future on a new steam-power plant at Santa Maria, which will be used to better the service of the coast towns. Santa Maria is at the end of a 224-volt transmission line connecting with the power plant at San Joaquin. The company is planning to extend its transmission line from Knowles to Raymond to supply electricity in the latter place. O. G. Wishon is general manager.

GILROY, CAL.—The municipal electric-light plant has been leased to the Coast Counties Gas & El. Co., Santa Cruz, for a period of ten years. Under the terms of the contract the company is to remove the poles and electric wires from Monterey Street and install the entire electric system in conformity to the State laws; also to erect on Monterey Street a complete electrolier-lighting system.

LOS ANGELES, CAL.—The employment of an expert to study the aqueduct power possibilities at Big Pine and Cottonwood Creeks and at the Owens River gorge has been recommended to the Board of Public Service Commissioners by E. F. Scattergood, chief electrical engineer.

SAN FRANCISCO, CAL.—The Northern California Pwr. Co., San Francisco, is planning to substitute No. 1 copper wire for the light aluminum wire now in use on its entire system.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., San Francisco, has applied to the State Railroad Commissioners for permission to issue $2,500,000 in capital stock, the proceeds to be used for additions and improvements.

POCATELLO, IDAHO.—Plans are being considered for the installation of an ornamental street-lighting system. They provide for the erection of 353 single-lamp standards, mounted with 250-cp. or 400-cp. nitrogen type C lamps, maintained by underground wires. About 35,000 ft. of underground cable will be laid; it is not yet decided whether armored cable or conductor in fiber conduit will be used. J. J. Williams is chairman of lighting committee.

WENDELL, IDAHO.—The installation of an ornamental street-lighting system in Wendell is under consideration by the City Council.

CULBERTSON, MONT.—Extensive improvements, including the installation of a new engine, large storage batteries and other electrical equipment, will be made to the local electric-light plant, owned by Donaldson Brothers, Culbertson.

HELENA, MONT.—Residents of the Broadwater addition have petitioned the City Council for the creation of a special improvement district in that section, providing for street grading, cement sidewalks and an ornamental street-lighting system.

SCOBEY, MONT.—The Scobey El. Lt. Co., it is reported, is contemplating extensions and improvements to its system.

CHEYENNE, WYO.—The Western Lt. & Pwr. Co., Boulder, Col., which controls the Cheyenne Lt., Fuel & Pwr. Co., contemplates improvements to the Cheyenne plant, involving an expenditure of $50,000.

GOLDEN, COL.—A movement has been started toward the installation of an electric-light plant in Golden. A committee, consisting of N. W. Osborne, John Reynolds and John Wallace, has been appointed to make investigations as to the cost, etc., of the proposed plant.

ROSWELL, N. M.—The installation of a large steam turbine and other improvements (to cost about $20,000) is contemplated by the Roswell Gas & El. Co.

SANTA FE, N. M.—James A. French, State Engineer, it is reported, has approved plans of the Rio Grande Lt., Ht. & Pwr. Co. for raising dam in White Rock Canyon, the power to be used to generate electricity for transmission to Albuquerque, Santa Fé, Las Vegas and other points. The cost of the proposed development is estimated at about $650,000.

Canada

WINNIPEG, MAN.—The proposal to install two gas engines in the high-pressure plant on James Avenue, East, and the erection of an overhead cable to the McPhillips Street pumping station, recommended by W. P. Brereton, city engineer, have been approved by the City Council.

HUNTSVILLE, ONT.—The Town Council, in conjunction with the Hydro-Electric Power Commission of Ontario, has decided to rebuild the municipal electric system and to erect a new substation. The work will be done under the supervision of the commission.

TORONTO, ONT.—The Toronto Hydro-Electric Power Commission has applied to the Board of Control for an additional appropriation of $1,375,000 for extensions.

WEST LORNE, ONT.—The by-law to appropriate $8,000 to provide funds for the installation of an electric distributing system in West Lorne will be submitted to the ratepayers on Dec. 20. Energy will be supplied by the Ontario Hydro-Electric Power Commission.

SHERBROOKE, QUE.—Alterations and improvements to the municipal electric-lighting plant and transmission lines are reported to be under consideration by the City Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 29, for furnishing structural bronze work, cutting-off machine, lead sleeves, cable terminals, electric cable and wire. Blanks and general information relating to this circular (No. 996) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

MANILA, P. I.—The Manila El. R. R. & Lt. Co., it is reported, has been awarded the contract for lighting the entire city, with the exception of the Paco district, for a period of ten years. The contract provides for ultimately increasing the street-lighting units from the present total of 1300 to about 2400.

1,162,747. Insulated Support for Electrical Devices; A. W. Burke, Wilmington, Pa. App. filed June 14, 1911. Attachable to ordinary high-tension insulators.

1,162,765. Holder for Crystal Detectors; J. H. Ghegan, East Orange, N. J. App. filed June 10, 1915. Contact mounted on a universal joint.

1,162,773. Electric Furnace; C. Hering, Philadelphia, Pa. App. filed May 1, 1913. For melting silver, gold, copper and the like.

1,162,782. Heater Filter; C. Jorein, Jr., and A. E. Jorein, Detroit, Mich. App. filed Jan. 14, 1915. For use in doctors' offices, etc.

1,162,788. Grid Resistance; D. L. Lindquist, Yonkers, N. Y. App. filed Jan. 21, 1913. Resilient means for maintaining grids in yielding engagement.

1,162,793. Waterproof Switch Joint; W. E. McEldowney, Denver, Col. App. filed May 27, 1913. Joint prevents water entering switch box.

1,162,830. System of Signaling by Wireless Telegraphy Under the Quenched-Spark Method; G. von Arco and A. Meissner, Berlin, Germany. App. filed Nov. 30, 1914. Obtains pure interference sounds.

1,162,831. Electric Switch; O. S. Walker and I. F. Williams, Worcester, Mass. App. filed March 14, 1914. For magnetizing coils of magnetic chuck.

1,162,837. Door Indicator; F. Williams, Somerville, Mass. App. filed Sept. 18, 1912. Registers door-opening hour; for stores, etc.

1,162,855. Lightning Rod; J. F. Goetz, Hartford, Wis. App. filed Jan. 25, 1915. Detachable connection for branch sections.

1,162,864. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed May 22, 1911. Push-button garter-spring construction.

1,162,865. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed May 22, 1911. Sheet-metal construction.

1,162,866. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed May 31, 1911. Has a self-contained switch unit.

1,162,881. Suspension Device for Fluid Compressors; W. J. Richards, Milwaukee, Wis. App. filed Sept. 25, 1913. For supporting motor-driven compressor beneath cars.

1,162,890. System of Train Control; G. P. Thurber, Pittsburgh, Pa. App. filed Nov. 5, 1908. Block system; gives notice of break-down in system.

1,162,897. Dough-Raising Device; B. Ames, Lowell, Mass. App. filed March 16, 1914. Maintains constant temperature.

1,162,899. Telephone Indicator; H. E. Beane, Bowling Green, Ky. App. filed Aug. 12, 1914. Indicates to subscriber which of a number of telephones is calling.

1,162,918. Electric-Welding Apparatus; W. E. Haskin, Flushing, N. Y. App. filed March 20, 1915. Automatically establishes arc.

1,162,921. Attachment Plug; M. Kerskovitz, Chicago, Ill. App. filed Nov. 16, 1914. One-piece construction.

1,162,931. Level; R. C. Kellogg and A. Johnson, New York, N. Y. App. filed Sept. 30, 1911. Has illuminating means.

1,162,953. Combined Bell and Buzzer; O. H. Steuwe and L. M. Jansen, Milwaukee, Wis. App. filed Feb. 11, 1915. Mounted on a single base.

1,162,974. Incandescent-Electric-Lamp Fixture; F. Buchanan, Syracuse, N. Y. App. filed Aug. 25, 1913. Novel arrangement of reflector casing.

1,162,991. Dynamo-Electric Machine; J. B. Entz, Cleveland, Ohio. App. filed July 5, 1913. Motor-generator for starting and lighting purposes on automobiles.

1,162,992. Pole Changer; C. J. Erickson, Chicago, Ill. App. filed Aug. 23, 1906. For converting battery current into alternating current.

1,162,996. Train-Wire Connector; A. J. Farrelly and G. B. Colegrove, Chicago, Ill. App. filed Sept. 27, 1910. For coupling train circuits between cars.

1,163,040. Centrifugal Switch; M. L. Selvry, Arlington Heights, and G. B. Sinclair, Winthrop, Mass. App. filed Dec. 18, 1905. Governor for controlling speed of electric motors.

1,163,063. System of Automatic Block Signaling for Electric Railroads; G. H. Benjamin, New York, N. Y. App. filed April 3, 1911. Signal-controlling devices connected in track circuits.

1,163,068. Electromagnetic Switch; C. W. Coleman, Westfield, N. J., and A. V. T. Day, New Rochelle, N. Y. App. filed July 6, 1908. For semaphore systems.

Record of Electrical Patents

Notes on United States Patents issued Dec. 7, 1915, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,163,069. Railway Traffic-Controlling Apparatus; A. V. T. Day, New Rochelle, N. Y. App. filed June 9, 1908. Uses track rails to form circuits.

1,063,070. Relay; A. V. T. Day, New Rochelle, N. Y. App. filed Oct. 29, 1908. Alternating-current polarizing type, for traffic control system.

1,063,079. Synchronizing Device; L. Gaumont, Paris, France. App. filed Jan. 4, 1907. For phonograph and motion-picture machines.

1,063,084. Electric Snap Switch; M. Guett, Hartford, Conn. App. filed June 3, 1915. Special detent mechanism.

1,063,082. Timer or Current Interrupter; C. F. Kettering, Dayton, Ohio. App. filed Nov. 14, 1910. For ignition systems; involves a yielding member.

1,063,114. Insulator; L. Stahl, Carey, Ohio. App. filed Feb. 25, 1915. Cleat construction.

1,063,132. Insulator Pin; C. G. Ette, St. Louis, Mo. App. filed March 1, 1915. Especially designed for mines.

1,163,139. Trolley Retriever; R. E. Gearhart, Maryville, Mo. App. filed Oct. 29, 1914. Special mount construction.

1,163,147. Individual Protective Arrangement for Interlocked Functions; W. S. Henry Rochester, N. Y. App. filed May 3, 1912. For signals and switches.

1,163,150. Motor Controller; A. J. Horton, White Plains, N. Y. App. filed Sept. 12, 1914. Two-button construction; can be locked against starting.

1,163,153. Electric Interlocking Protective Device; W. K. Howe, Rochester, N. Y. App. filed Oct. 7, 1911. Only the function affected by cross-current is rendered inoperative.

1,163,154. Electric Controlling Device; W. K. Howe, Rochester, N. Y. App. filed May 6, 1912. Controls movement and indicates completion of movement of remote device.

1,163,163. Primary Electric Battery; G. A. Lutz, Cranford, N. J. App. filed March 22, 1915. Has slitted sheet-iron container element.

1,163,171. Cross-Protection Device; W. J. Plogsted, Yonkers, N. Y. App. filed Aug. 30, 1911. For power-operated interlocked switches and signals.

1,163,180. Means for Strengthening Weak Electrical Impulses; W. Schloemilch and A. Leib, Berlin, Germany. App. filed June 16, 1910. Radiotelegraphy.

1,163,181. Lightning-Rod Coupling; E. A. Schmitt, Greencastle, Ind. App. filed Dec. 23, 1914. Secures firm joint between sections.

1,163,182. Automatic Block-Signal System for Electric Railways; O. E. Stevens, New York, N. Y. App. filed June 26, 1908. Increased safety factor and decreased cost; special bond construction.

1,163,190. Railway Signal; E. Woltmann, New York, N. Y. App. filed Nov. 6, 1909. Simple and reliable system of circuits.

1,163,191. Ship's Telegraph; F. W. Wood, Brooklyn, N. Y., and H. Laning, Petersburg, Ill. App. filed Aug. 8, 1910. Reliable under all conditions of service; mechanical transmission.

1,163,199. License-Plate Carrier and Signal; R. B. Baker, Galion, Ohio. App. filed Sept. 12, 1914. Indicates to following vehicles.

1,163,201. Mechanical Sounder for Telegraph Systems; P. P. Banholzer, Philadelphia, Pa. App. filed April 3, 1912. Attachable to telephone instruments.

1,163,226. Electric Meter; E. Evans and H. Ziememdorff, Berlin, Germany. App. filed Nov. 12, 1912. Indicates excess energy consumed.

1,163,267. Disinfectant Holder; F. Sayles, Longmont, Col. App. filed May 29, 1915. Attaches to telephone mouthpiece.

1,163,268. Means and Method of Varying the Voltage of Alternating Currents; E. H. Schwarz, New York, N. Y. App. filed April 6, 1911. For starting purpose and the like.

1,163,286. Process of Recovering Zinc from an Acid Sulphite Solution; C. S. Vadner, Salt Lake City, Utah. App. filed May 25, 1914. Utilizes sulphurous fumes from ore smelting.

1,163,306. Regulating System; R. W. Armstrong, New York, N. Y. App. filed Nov. 10, 1910. Sensitive and accurate voltage regulation.

1,163,321. Electrical Water-Purifying Appliance; H. Clark, Kansas City, Mo. App. filed July 14, 1915. For household or family use.

1,163,326. Telephone Attachment; D. Y. Donaldson, Denver, Col. App. filed Dec. 14, 1914. For supporting transmitter and receiver, attachable to ordinary desk telephone.

1,163,329. Filament for Incandescent Electric Lamps; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed May 31, 1907. Vaporized tungsten deposited on core material.

1,163,337. Production of Cathode-Forming Sheets; E. A. Guggenheim, New York, N. Y. App. filed Dec. 22, 1914. Electrolytic process.

1,163,346. Signal System; C. H. Johnson, Boylston, and G. E. Johnson, Worcester, Mass. App. filed April 6, 1915. Annunciator system.

1,163,349. Combined Push-Button-Controlled Doorbell and Illuminating Sign; G. Kimball, Ouray, Col. App. filed Oct. 26, 1914. Illuminates the house number.

1,163,361. Regulator; J. A. Paasche, Chicago, Ill. App. filed May 9, 1910. For maintaining uniform pressure in a tank.

1,163,371. Fastening Device for Electrical Conductors; J. Schade, Jr., New York, N. Y. App. filed May 22, 1912. Fahnestock type.

1,163,372. Spring-Fastening Device; J. Schade, Jr., New York, N. Y. App. filed July 13, 1914. Modification of Fahnestock-type construction.

1,163,388. Switch Box; J. H. Williams, East Cleveland, Ohio. App. filed Aug. 4, 1913. Insertable in wall.

1,163,390. Automatic Telephony; W. M. Bruce, Jr., Springfield, Ohio. App. filed Nov. 4, 1911. Automatic-switch construction.

1,163,412. Pool-Table-Pocket Light; H. Jorstad, Stanhope, Iowa. App. filed Jan. 6, 1915. Light indicates whether ball is in the pocket.

1,163,424. Alternating-Current Motor Starter; J. C. Lincoln, Cleveland, Ohio. App. filed Dec. 20, 1913. Auto-transformer type.

1,163,446. Lamp Socket; T. O'Donnell, Ironwood, Mich. App. filed May 24, 1915. Cluster socket construction.

1,163,468. Process for Determining the Nature of the Subsoil by the Aid of Electricity; C. Schlumberger, Paris, France. App. filed Jan. 2, 1913. For detecting minerals, stone layers or the like.

1,163,469. Location of Ores in the Subsoil; C. Schlumberger, Paris, France. App. filed Sept. 25, 1913. Utilizes phenomena of polarization.

1,163,473. Synchronizer; M. L. Svery, Arlington Heights, Mass. App. filed April 7, 1911. Especially for electrical musical instruments.

1,163,498. Manufacture of Metallic Amides, Cyanamides and Cyanides; E. A. Ashcroft, London, England. App. filed April 14, 1910. Direct production by electrolysis.

1,163,501. Electric Generator; J. Bell, Cincinnati, Ohio. App. filed Aug. 17, 1914. Oppositely rotating armature and field driven from single pitman.

1,163,514. Supply of Energy to Electric-Railway Systems; C. H. Douglas, Patcham, England. App. filed June 25, 1915. Pressure supplied to any given section is controlled by a generator.

1,163,536. Electric Water Heater; L. C. Henriksen, Portland, Ore. App. filed May 19, 1915. Instantaneous type.

1,163,539. Telegraph; A. Hjort, New York, N. Y. App. filed April 1, 1912. Employs alternating current.

1,163,568. Electric Spark-Gap; F. G. Simpson, Seattle, Wash. App. filed March 20, 1915. Quenches the spark.